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ECOLOGY OF EASTERN PRICKLY PEAR CACTUS (*OPUNTIA HUMIFUSA*) IN OAK OPENINGS PRESERVE, NORTHWESTERN OHIO

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ABSTRACT

Opuntia humifusa (eastern prickly pear cactus) is listed as potentially threatened in Ohio, and we examined the characteristics of *O. humifusa* sites in Oak Openings Preserve in northwestern Ohio's Oak Openings region in an attempt to provide data that may help protect this species. *Opuntia humifusa* occurrences were associated with loose sands of the xeric Udipsamment Ottokee and Oakville soil series on sites that had been cleared before the 1940s during failed agricultural attempts. Shading by encroaching canopy trees is a threat to several *O. humifusa* populations in Oak Openings Preserve, and treatments that reduce canopy cover at these sites may help sustain this species and increase the proportion of flowering individuals. Because the patchy distribution of *O. humifusa* makes the species susceptible to local extinctions, the acquisition of sites by conservation organizations containing *O. humifusa* or providing suitable habitat is consistent with the perpetuation of this rare species in the Oak Openings region. Sandy sites previously disturbed by agricultural clearing, sand mining, or other soil disturbances should not be overlooked for their potential to provide *O. humifusa* habitat in this region.

INTRODUCTION

Opuntia humifusa (Raf.) Raf. (eastern prickly pear cactus) has a patchy but wide distribution in the eastern United States and southeastern Canada, ranging from Massachusetts through Wisconsin to southern Florida (Benson 1982). In the Great Lakes region, *O. humifusa* occurs in 10 counties in western lower Michigan (Voss 1985), southern Ontario including Point Pelee National Park (Reznicek 1982), four northern Ohio counties near Lake Erie and 12 southern Ohio counties (Cooperrider 1995), northern Indiana and Illinois near the southern tip of Lake Michigan (Swink & Wilhelm 1994), and scattered localities in southern Wisconsin (Benson 1982).

Habitats of *Opuntia humifusa* in the Great Lakes region, based on herbarium records and published descriptions, vary widely (Noelle & Blackwell 1972). For example, Reznicek (1982) described two *O. humifusa* sites inland from Lake Erie in southern Ontario as low, south- and west-facing sandy ridges. In the Chicago region, *O. humifusa* occurs in *Quercus* savannas, old cemeteries on sandy soils that have been periodically mowed, and human-made limestone bar-

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rens (Swink & Wilhelm 1994). Kellerman (1901) reported that *O. humifusa* was common in open *Quercus* woods near Sandusky in northern Ohio, and this species also occurred in sand plains (Jennings 1908) and open fields (Moseley 1899) in the same region.

Opuntia humifusa is listed as potentially threatened in Ohio (Ohio Division of Natural Areas and Preserves 2000). Regions supporting *O. humifusa* are widely disjunct in Ohio, and suitable habitats within these regions are patchy, making *O. humifusa* prone to local extinctions (Noelle & Blackwell 1972; Cooperrider 1995). Nonetheless, there are few detailed studies of the habitats and ecology of this species in the Great Lakes region and in the eastern United States in general. To help fill this gap in our knowledge in Ohio, made more serious by the potentially threatened status of *O. humifusa*, we studied *O. humifusa* habitats in Oak Openings Preserve in northwestern Ohio. The objective of this study was to document the environmental, plant community, and historical land-use characteristics of *O. humifusa* sites in Oak Openings Preserve in an attempt to provide data that may help protect this species.

METHODS

Study Species

Nomenclatural history of *Opuntia humifusa* is convoluted (Noelle & Blackwell 1972). Gleason & Cronquist (1991) report that this species has been referred to as *O. calcicola*, *O. compressa*, *O. opuntia*, *O. pollardii*, *O. rafinesquei*, and *O. vulgaris*. Morphological characteristics of *O. humifusa* vary widely across its range, but authors in many regions have concluded that *O. humifusa* is a single species without varieties (Hanks & Fairbrothers 1969b; Voss 1985). This species often grows in clumps, and is typically 7.5–10 cm tall (Benson 1982). Flowering occurs in June and July (Cooperrider 1995), with yellow, showy flowers (Figure 1). Reproduction occurs both by seed and by the detachment of partial or full pads from a parent plant—these fragments readily root on soil surfaces (Voss 1985). *Opuntia humifusa* is a perennial and overwinters in its vegetative form, but no information was found in the literature as to the potential length of its life span. *Opuntia humifusa* often colonizes open, sandy, disturbed areas, and the species may be reduced or eliminated by shading during succession (Wallace & Fairbrothers 1987).

Study Area

Oak Openings Preserve is managed by the Toledo Area Metroparks and is located in Lucas County, northwestern Ohio (Figure 2). The preserve consists of a 1496-ha mosaic of wet prairies, open fields, conifer plantations, *Quercus* savannas, woodlands, and forests. Soils are sandy and are derived from beach dunes deposited during the Pleistocene at the western shoreline of Lake Warren, a glacial lake now partially occupied by Lake Erie (Moseley 1928). Presettlement vegetation in this region, based on 1821 land survey records, consisted of 51% *Quercus velutina* (black oak) and *Quercus alba* (white oak) savanna or barrens (< 43 trees ha⁻¹), 23% *Quercus* woodland (> 43 trees ha⁻¹), and 27% treeless wet prairie (Brewer & Vankat 2001). Restoration of these native ecosystems is ongoing and is a high priority in Oak Openings Preserve (Abella et al. 2001).

Data Collection

The Toledo Metroparks maintains a continuously updated database of rare plant locations in Oak Openings Preserve based on formal botanical surveys and observations throughout the preserve. *Opuntia humifusa* occurs at eight known sites in Oak Openings Preserve, and because of the unique and distinctive appearance of *O. humifusa* these sites likely represent all or nearly all extant populations of this species in Oak Openings Preserve. We sampled each of these sites in May, July, and August 2002.

At each site, we counted the number of *Opuntia humifusa* individuals and clumps. Distin-



FIGURE 1. Aerial view of *Opuntia humifusa* flowering in Oak Openings Preserve, northwestern Ohio. (Photo courtesy of R.G. Jacksy, Toledo Area Metroparks).

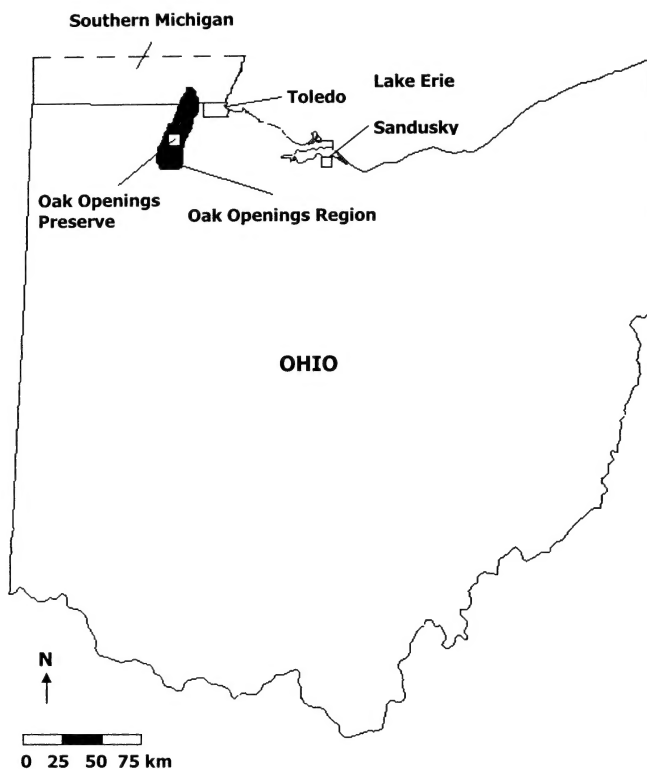


FIGURE 2. Location of Oak Openings Preserve, Lucas County, northwestern Ohio ($41^{\circ}33'N$, $83^{\circ}51'W$).

guishing individual *O. humifusa* is difficult because multiple pads can arise from the same root system (Ohio Division of Natural Areas and Preserves 2000). We defined and counted individual *O. humifusa* as a pad growing more than 30 cm from surrounding pads, and a clump as a cluster of *O. humifusa* individuals growing more than 1.5 m from surrounding clumps or individuals. We sampled the soils at each site to a depth of 130 cm using a bucket auger to confirm the soil series mapped for the site in the soil survey (Stone et al. 1980). The two series on which *O. humifusa* occurred, Ottokee and Oakville, are distinguished based on the presence (Ottokee) or absence (Oakville) of mottling within a depth of 100 cm (Stone et al. 1980). We determined Oi horizon thickness to the nearest cm around *O. humifusa* clumps using a ruler. Landforms at each site were described following descriptions in the soil survey (Stone et al. 1980). We measured canopy cover at each site using a densitometer (Geographic Resource Solutions, Arcata, CA) based on estimates to the nearest 5% cover. We also recorded the relative abundances of other plant species at each site, and potential threats to *O. humifusa* such as exotic species or shading. Plant nomenclature follows Voss (1972, 1985, 1996).

Elevations of sites were obtained from a U.S. Geological Survey topographic map (Whitehouse quadrangle, 1964). To evaluate past land uses of the sites, we obtained 1939 aerial photographs (1:240,000 scale) of Oak Openings Preserve from the Natural Resources Conservation Service (Maumee, OH).

RESULTS

Characteristics of the eight *Opuntia humifusa* sites in Oak Openings Preserve are summarized in Table 1 and are described individually in the following sections. Numbers after each site name in the following sections correspond to the site's number in Table 1.

Reed Plantation (1)—Associates of *Opuntia humifusa* at this site include *Rubus flagellaris* (northern dewberry), *Fragaria virginiana* (wild strawberry), *Lepidium campestre* (field peppergrass), *Rumex acetosella* (sheep sorrel), *Antennaria* spp., occasional *Asclepias tuberosa* (butterfly-weed), and seedlings of *Acer rubrum* (red maple), *Prunus serotina* (black cherry), *Quercus velutina*, and *Sassafras albidum* (sassafras). Canopies consist of ca. 20-cm diameter *Quercus velutina*, *Quercus palustris* (pin oak), *Pinus strobus* (eastern white pine), and *Pinus banksiana* (jack pine). The site consists of an opening adjacent to the south of a *Pinus banksiana* plantation and north of an *Acer rubrum*-dominated forest on a different soil series (Tedrow, a moist series [Stone et al. 1980]). Few *O. humifusa* at this site flowered, and threats to this population appear to be shading by an encroaching canopy of *Quercus* and *Pinus*, smothering by leaf litter, and the presence of an invasive shrub *Elaeagnus umbellata* (autumn olive).

Yucca Meadow (2)—This site has been restored to *Quercus* savanna by the thinning of *Quercus velutina* and the removal of *Acer rubrum*. *Pinus resinosa* (red

TABLE 1. Summary of characteristics of *Opuntia humifusa* sites in Oak Openings Preserve, northwestern Ohio

Site	1	2	3	4	5	6	7	8
No. <i>Opuntia</i> clumps	20	18	1	2	9	15	2	5
No. <i>Opuntia</i> individuals	69	61	13	3	28	79	10	32
Size <i>Opuntia</i> area (m ²) ¹	6000	2400	100	50	400	1000	100	100
Landform type	Dune knoll	Dune knoll	Dune knoll	Dune ridge	Dune knoll	Dune knoll	Beach ridge	Beach ridge
Elevation (m)	215	217	216	219	215	215	215	215
Soil series ²	Ottokee	Oakville	Oakville	Oakville	Oakville	Ottokee	Oakville	Ottokee
Oi horizon	Patchy ³	Absent	Patchy	Absent	Patchy	Absent	Absent	Patchy
Canopy cover (%) ⁴	50	<5	<5	0	50	50	0	0
1939 land use	Agri-culture	Agri-culture	Agri-culture	Sand dune	Agri-culture	Agri-culture	Agri-culture	Agri-culture

¹ Size of area containing *Opuntia* including area between clumps.

² Ottokee and Oakville series classified as mixed, mesic Aquic and Typic Udipsamments (Stone et al. 1980).

³ Patchy = ranges from absent to a maximum of 4 cm thick across site.

⁴ Average of site or point-sample above *Opuntia* for small-sized sites.

pine) plantations are adjacent to this site to the west, and the rest of the site is surrounded by closed-canopy *Quercus* forest. *Andropogon scoparius* (little bluestem), *Krigia virginica* (dwarf-dandelion), *Lupinus perennis* (wild lupine), *Rubus flagellaris*, *Lespedeza capitata* (bush clover), *Fragaria virginiana*, *Asclepias tuberosa*, and occasional *Yucca filamentosa* (yucca) dominate this site. Encroachment by the exotic *Elaeagnus umbellata* is a possible threat to this population of *Opuntia humifusa*.

Vasvery Homestead (3)—This site is adjacent to a private inholding to the north, a road and a *Pinus strobus* plantation to the west, and a restored *Quercus* savanna to the south and east. Common plants near *Opuntia humifusa* at this site include *Rubus flagellaris*, *Euphorbia corollata* (flowering spurge), *Rhus copallina* (winged sumac), *Lespedeza capitata*, and seedlings of *Quercus velutina*. Two other state-listed plants, *Asclepias amplexicaulis* (blunt-leaf milkweed) and *Prunus pumila* (sand cherry) occur within 100 m of *O. humifusa* at this site. Because of its proximity to a private inholding, the area where *O. humifusa* occurs at this site was not included in restoration treatments that were applied to adjacent areas, and threats to this population of *O. humifusa* include shading by encroaching canopy trees and brush.

Railroad Ridge (4)—Common plants around *Opuntia humifusa* at this site include *Quercus velutina* seedlings, *Carex* spp., *Rubus flagellaris*, *Euphorbia corollata*, *Rumex acetosella*, *Lepidium campestre*, *Asclepias tuberosa*, *Asclepias syriaca* (common milkweed), *Krigia virginica*, *Lespedeza capitata*, *Ambrosia artemisiifolia* (common ragweed), and *Conyza canadensis* (horseweed). This site comprises the highest elevation of all *O. humifusa* sites, and soils consist of loose, shifting sand. A bike trail is located 30 m north of the site, and this trail occupies an old railroad bed present in 1939. The site was an open sandy area in 1939, and is the only *O. humifusa* site not in agriculture at that time (Table 1). Removal of *O. humifusa* by park visitors is a potential threat to *O. humifusa* at this site because of its proximity to the trail, although there was no present evidence that any *O. humifusa* have been recently removed.

Jack Pine Opening (5)—This site consists of an opening within a *Pinus banksiana* plantation. Canopy trees include *Quercus palustris* and *Quercus velutina*, and ground-flora includes *Rubus flagellaris*, *Krigia virginica*, *Rumex acetosella*, *Rhus copallina*, *Yucca filamentosa*, and seedlings of *Quercus velutina*, *Quercus palustris*, and *Sassafras albidum*. Potential threats to this population of *Opuntia humifusa* are shading by encroaching canopy trees and smothering by leaf litter.

Douglas-Fir Border (6)—Adjacent to the east of a *Pseudotsuga menziesii* (Douglas-fir) and *Picea abies* (Norway spruce) plantation, *Opuntia humifusa* on this site occur in an opening surrounded by *Quercus* saplings (Figure 3). Associates of *O. humifusa* include *Pteridium aquilinum* (bracken fern), *Lepidium campestre*, *Andropogon scoparius*, and *Quercus velutina* seedlings. Shading by



FIGURE 3. *Opuntia humifusa* clump (left foreground) in an opening adjacent to a *Pseudotsuga menziesii* and *Picea abies* plantation established in 1950, Oak Openings Preserve, northwestern Ohio. Shading by encroaching canopy trees is a potential threat to *O. humifusa* at this site and several other sites in Oak Openings Preserve. (Photo by S.R. Abella, 11 May 2002).

encroaching *Quercus* saplings and height growth of conifers in the plantation are potential threats to *O. humifusa* at this site.

Girdham Field (7)—This site is 50 m southeast of a *Pinus resinosa* and *Pinus strobus* plantation and is part of a 12-ha meadow with occasional large *Quercus alba* that has been restored from closed-canopy *Quercus* and *Acer rubrum* forest. Other species occurring near *Opuntia humifusa* include *Panicum clandestinum* (deertongue), *Rubus flagellaris*, *Potentilla simplex* (common cinquefoil), *Fragaria virginiana*, and *Rumex acetosella*. There are no apparent threats to this *O. humifusa* population.

White Oak Savanna (8)—A 122-cm diameter open-grown *Quercus alba* occurs within 50 m of the *Opuntia humifusa* clumps at this site that is part of the same meadow as the Girdham Field site (Figure 4). Aerial photographs taken in 1939 indicate this site was cleared for agriculture at that time, but the large *Q. alba* is visible in the photograph and was apparently not removed during agricultural clearing. Common plants around *O. humifusa* at this site include *Rubus flagellaris* and *Ambrosia artemisiifolia*. No imminent threats to *O. humifusa* are apparent at this site.



FIGURE 4. White oak savanna *Opuntia humifusa* site characterized by a 122-cm diameter open-grown *Quercus alba*, Oak Openings Preserve, northwestern Ohio. *Opuntia humifusa* at this site occurs in clumps scattered around the *Q. alba*. (Photo by S.R. Abella, 4 August 2002).

DISCUSSION

Habitats of Opuntia humifusa

Occurrences of *Opuntia humifusa* in Oak Openings Preserve are associated with the xeric Oakville and Ottokee soil series, occupying the highest elevations in the preserve on dune knolls, dune ridges, and beach ridges. However, only a small areal portion of these series support *O. humifusa*, and many apparently suitable sites were unoccupied by *O. humifusa*. It is unclear what factors constrain the distribution of *O. humifusa* within areas of the Oakville and Ottokee soils. Consistent with a study of *O. humifusa* habitats in New Jersey (Hanks & Fairbrothers 1969a), there does not appear to be a distinct plant community in which *O. humifusa* occurs in Oak Openings Preserve. Plant assemblages associated with *O. humifusa* varied by site, with *Rubus flagellaris* exhibiting the highest constancy (87%) at *O. humifusa* sites. Attempts to locate additional *O. humifusa* populations in Oak Openings Preserve, if they exist, could focus on open areas of loose sand of the Oakville and Ottokee series, areas that have been disturbed by agricultural clearing or other disturbance, and areas supporting other plant species characteristic of dry, open environments.

Seven of eight *Opuntia humifusa* sites in Oak Openings Preserve were in

agriculture in 1939, suggesting *O. humifusa* was present before clearing and the plants or seed survived, or *O. humifusa* did not occur on these sites before clearing and became established sometime after farm abandonment. It is possible that soil disturbances created by agricultural clearing provided a favorable environment for *O. humifusa* colonization. Many of the abandoned farms were converted to *Pinus* plantations in the 1940s and 1950s when land for Oak Openings Preserve was acquired by the Toledo Metroparks (Abella & MacDonald 2002). Because all eight presently known *O. humifusa* sites occur within 100 m of a conifer plantation, it is uncertain if some *O. humifusa* sites were lost by the conversion of abandoned farms to plantations.

Origin and Distribution of *Opuntia humifusa*

The origin of *Opuntia humifusa* in the Oak Openings region is unclear. In Wood County, 13 km east of the city of Bowling Green and 35 km southeast of Oak Openings Preserve, Moseley (1931) documented an *O. humifusa* occurrence on a site known to have been a long-term Native American campsite. Moseley (1931) also noted that *O. humifusa* occurrences around Sandusky in northern Ohio east of the Oak Openings region were associated with the presence of Native American artifacts. He postulated that Native Americans had introduced *O. humifusa* to northern Ohio because they favored its edible, succulent fruit. In Moseley's classic paper (1928) on the flora of the Oak Openings region based on his botanical surveys in the 1890s and early 1900s, he does not mention *O. humifusa* as occurring in the region. Moseley's routes through Oak Openings are uncertain, and there could be many reasons why he did not document the occurrence of *O. humifusa* if the species did occur in the Oak Openings region at that time. Noelle & Blackwell (1972) reported that the earliest known herbarium record of *O. humifusa* in Ohio other than for the Sandusky region is a collection in 1911 in Adams County in extreme southern Ohio. However, Noelle & Blackwell (1972) asserted that the absence of herbarium records for *O. humifusa* should be interpreted cautiously because of the scattered distribution of *O. humifusa* and the incompleteness of early collection records. The first published documentation of *O. humifusa* in the Oak Openings region appears to be by Easterly (1979) during his rare plant survey. It is uncertain how *O. humifusa* became established in the Oak Openings region and for how long the species has been in this region.

Protection of *Opuntia humifusa*

Shading has been widely cited to reduce flowering and eventually eliminate *Opuntia humifusa* (Hanks & Fairbrothers 1969a; Reznicek 1982; Wallace & Fairbrothers 1987). Five of eight *O. humifusa* sites in Oak Openings Preserve exhibited encroachment by trees or shrubs, and shading appears to be an imminent threat to these *O. humifusa* populations. Restoration treatments that restore the open *Quercus* savanna vegetation native to *O. humifusa* sites (Abella et al. 2001) would probably alleviate shading threats to *O. humifusa* and increase the proportion of flowering individuals. Continued monitoring of these sites is necessary to ascertain the temporal dynamics of *O. humifusa*. Although the presettlement distribution of *O. humifusa* in Oak Openings Preserve is not known, the

present fragmented nature of the preserve and the localized occurrences of *O. humifusa* suggest that establishing *O. humifusa* on additional sites in Oak Openings Preserve might be desirable. *Opuntia humifusa* can be established by removing pads from existing plants and planting the pads (Voss 1985).

Because of the potentially threatened status of *O. humifusa* in Ohio, the acquisition of sites by conservation organizations containing *O. humifusa* or providing suitable habitat in the Oak Openings region is consistent with the perpetuation of this rare species in Ohio. Results of this study suggest that sandy sites disturbed by agricultural clearing, sand mining, or other soil disturbances should not be overlooked for their potential to provide *O. humifusa* habitat in the Oak Openings region.

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ADDITIONS AND CORRECTIONS TO *MICHIGAN FLORA*, PART III

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The first printing (7000 copies) of *Michigan Flora*, Part III, published in 1996 and covering the families of sympetalous dicots, is nearly exhausted and a second printing is in press so that the work will not go out of print. (Note that the only source of all three volumes is now the co-publisher, the University of Michigan Herbarium.) There has been much recent ferment in circumscription of certain included families (e.g., Ericaceae, Caprifoliaceae) and genera (e.g., *Aster*), but this is not the place to deal with any consequent changes in nomenclature.

However, the new printing will include a page of corrections and additions [598 (preceding the index)]. Persons possessing a copy of the first printing may photocopy the identical information printed below, for insertion into their existing copy. (Similar supplements for Part II were published in *The Michigan Botanist* 37: 12–13 (1998) and on pp 725–727 in the second printing of that volume; and for Part I some additional species were listed on p. x of the 3rd printing. [Printing may be determined by checking the reverse side of the title page.]

NOTE TO THE SECOND PRINTING: CORRIGENDA

Omitting self-evident typographical errors and slips in formatting, the following corrections should be made to avoid misleading the reader. (These are not new information, but represent problems at the time of publication.)

- p. 56, line 11 under *P. mistassinica*: for *quinquefolia* read *quinqueflora*
- p. 192, line 6: for “Lamarck” read “Dunal”
- p. 262, line 7 of key: measurement should be 12 mm (not 12 cm)
- p. 296: first word of first lead of couplet 6 should be Corolla
- p. 309, line 2 above References: *V. alnifolium* Marshall and *V. lantanoides* Michaux should be reversed
- p. 377, line 2 of couplet 16 should lead to couplet 3 (not 2)
- p. 413, figure in line 2 of second lead in key should be 1 cm (not 1 mm)
- p. 486, 2nd Semple reference: date should be 1987
- p. 491, line 5 under *A. furcatus*: for “Washtenaw” read “Monroe”
- pp. 514, 515, & Index: generic name should be spelled **Onopordum**
- p. 536, line 2 under *L. squarrosa*: add “and Rochester” after “Detroit”
- p. 611: page for *Lindernia* should be 236 (not 326)
- p. 614: page for *Oregano* should be 162 (not 161)

NOTE TO THE SECOND PRINTING: ADDENDA

Updating of the distribution maps is not feasible at this time, but listed below are species in families covered by this volume which have been documented (at least in the herbaria consulted) as occurring outside of cultivation in Michigan. Species marked with an asterisk are not indigenous (or only questionably so) in this state. Recorded counties are in brackets.

*Syringa xhenryi** [Schoolcraft]

Phlox latifolia [Lenawee]

*Lamiastrum galeobdolon** [Emmet, Washtenaw]

*Rhinanthus minor** [Houghton]

Campanula latifolia [Gogebic]

Arnica lonchophylla [Keweenaw (I. Royale)]

*Carthamus tinctorius** [Mecosta]

*Taraxacum palustre** [Chippewa (Drummond I.), St. Clair]

It may be of interest to note, in passing, that the discoverers of these eight additions to the state flora include 10 different people, most of whom are not professional botanists. Furthermore, the last species discovered in Part III (and barely mentioned: footnote on p. 378) would add an 11th person to those responsible for the nine most recent discoveries in Michigan's sympetalous families: Fred Case, Allison Cusick, Steve Garske, Don Henson, Peter Hyypio, Will MacKinnon, Steve Ross, Bob Smith, Ed Voss, Bev Walters, and Ellen Weatherbee.

REVIEW

Gleason, Henry A.[†] and Arthur Cronquist[†]. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. 2004, the seventh printing of the second edition of 1991. xlv + 993 pages. ISBN 0-89327-365-1. Hardbound, \$69; The New York Botanical Garden Press, Bronx, NY 10458. www.nybg.org, and click on *Science* to get to the ordering page.

This is **not** intended to be a revised edition that could be labeled edition 3. That fact is made abundantly clear, on the title page, in the Foreword, and even on the spine: "1991" and don't you forget it!

But it is very different. First of all, there's a table of contents; a Foreword that explains the printing history, and then a biographical sketch of the lives of both authors, with photographs. The glossary, which in past printings preceded the keys, has been moved to the back, just before the two indexes, one to common names, a second to scientific names. Page size has been increased slightly, in order to permit some additions and corrections, but the internal pagination (the actual treatments) is unaltered. So, *Adiantum* is still on page 16, but now there's a key to the two species covered, which had somehow been overlooked in earlier printings. The half page of nomenclatural innovations of earlier printings is removed; there are no new names published here.

Quite a number of botanists contributed remarks on typographical errors that were scattered through previous printings. There were instances where the two parental species of hybrids were not in alphabetical order, as in *Isoëtes*, and these kinds of slips are now corrected.

But *Scirpus* still has the same circumscription as before. This is but one of dozens of places where modern thinking would call for half a dozen genera—they're not here, though their synonyms under *Trichophorum*, *Schoenoplectus*, *Isolepis*, *Blysmus*, and *Bolboschoenus* are given. At this point, you're thinking, "Oh dear, what happened to traditional *Aster*?" and the answer is, "It's just the same as before, without even the addition of generic names adopted in modern revisions." As I said, this is not a revised, third edition. It is a corrected and improved printing.

The eagle-eyed reader might notice that authors for binomials have been "improved." In earlier printings, the validating author was often not cited, as in *Carex granularis* Muhl., number 131 on p. 724 of both printings. The species was in fact described and published by Willdenow in Berlin, from material sent to him by Muhlenberg from Pennsylvania, and the specific epithet was suggested by Muhlenberg. It therefore should be cited as *Carex granularis* Muhl. ex Willd., or if shortened, then simply *Carex granularis* Willd. Arthur Cronquist never liked this procedure, and never used it—that is to say, he shortened the authorship citation, but contrary to the International Code of Botanical Nomenclature. A quick glance will show that the manual is now sprinkled with such changes, which are in accord with the Code. (This same species in Voss' Michigan Flora, volume 1, page 301, is given as *Carex granularis* Willd., as you would expect from an author who was also an editor of the ICBN for so many years.)

And consider *Fraxinus profunda*—earlier printings had its authorship as *Fraxinus profunda* (Bush) Bush. Not true. Bush originated the name at some unspecified infraspecific rank, and a few years later Britton (not Bush) elevated the epithet to specific rank, and it is therefore to be cited as *Fraxinus profunda* Bush ex Britton, as given in this new printing.

Changes, alterations, corrections. Yes. Hundreds of them. Enough to justify buying the seventh printing? Yes, I think so. And the New York Botanical Garden is a running a special combined offer: The Illustrated Companion to Gleason and Cronquist's Manual is normally offered at \$125, but if you order both the Companion and the Manual, they'll sell you the two for \$150 plus shipping.

The last page of the book, unnumbered, is an especially poignant photograph. Turn there first, when you have the new book in hand. The picture is explained in the Foreword on page v.

Patricia and Noel Holmgren made all this happen; the botanical community is very much in their debt.

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A COMPARISON OF PREY CAPTURING EFFICIENCY BETWEEN TWO SPECIES OF SUNDEW, *DROSERA LINEARIS* AND *DROSERA ROTUNDIFOLIA*

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ABSTRACT

Members of the genus *Drosera* (sundews) are best known for their ability to capture insects in order to supplement low levels of nutrients (specifically nitrogen and phosphorus) present in the habitats in which they live. Two species, *Drosera linearis* (long-leaved sundew) and *Drosera rotundifolia* (round-leaved sundew), use the same basic mechanisms to capture prey, but differ in the shapes of their leaves and their preferred habitats. I aimed to determine whether one species was more efficient at capturing insects than the other, and if so, ascertain the reasons for such a disparity. In a rich fen in the northern lower peninsula of Michigan, I calculated percentages of leaves containing insects and counted the numbers of insects captured by these leaves per unit area for both species. *D. linearis* individuals had a higher percentage of leaves containing insects and caught an average of four times as many insects per leaf and 14.7 times as many insects per plant as *D. rotundifolia*. *D. linearis* was also 2.3 times more efficient at capturing insects than *D. rotundifolia*, calculated on the basis of leaf area. These results are most likely due to differences in the orientation and shape of leaves as well as differing levels of moisture, sunlight, and interspecific competition between microhabitats.

INTRODUCTION

Drosera linearis (long-leaved sundew) and *Drosera rotundifolia* (round-leaved sundew) coexist only in a few relatively small areas, one of which is in the fens of the Great Lakes Region (Slack 1979). The relationship between these two species is especially interesting because of their similarities in prey-capturing mechanisms, though they differ in structure and microhabitat preference. (For simplicity, all prey will be referred to as "insects" even though captured prey included other arthropods.)

Because of their mechanisms for capturing insects, *Drosera* and *Pinguicula* (Lentibulariaceae) can be categorized as "active fly-paper traps" (Slack 1979), because these species utilize tentacles (trichomes) tipped with a sticky substance to attract and immobilize insects, which land on them. Unlike their "passive fly-paper" counterparts, these species are also able to actively encompass their prey with their trichomes as well as with the margins of the leaf (Slack 1979). This is not necessarily a tactic used for securing prey; rather, the more trichomes that are in contact with the prey, the faster digestion and nutrient absorption occur (Slack 1979).

Drosera linearis has long slender leaves (~2.5 mm across), which are held erect and extend two to three cm into the air. It prefers the mineral-rich alkaline conditions of wet ground between hummocks in rich fens (Juniper 1989). *Drosera rotundifolia* has fewer, round leaves (~6 mm in diameter) that are spread flat in a rosette on the ground. It prefers the drier, more acidic areas created by *Sphagnum* beds on the tops of hummocks around the edges of fens as well as those scattered within (Thum 1986). *Drosera rotundifolia* is a shade-intolerant species that does not survive well with competing plants that reduce its access to sunlight (Stewart & Nilsen 1992). It is especially at a disadvantage in nutrient-rich areas where larger plants are more numerous. *D. rotundifolia* plants in the shade generally have larger leaves that are used to gather more sunlight (Thum 1989). Plants with larger leaves are also capable of capturing prey in larger numbers and of larger sizes (Schulze & Schulze 1990). Although there is no specific information on the effects of light levels on *D. linearis*, most members of *Droseraceae* are shade-intolerant (Juniper 1989). Because *D. linearis* tends to grow in the most open areas of fens, it is presumably even less shade-tolerant than *D. rotundifolia*.

This study was a comparison of insect-capturing efficiency between *D. linearis* and *D. rotundifolia*, taking into account both species' relative abundances, leaf orientations, and surface areas. Results were used to better understand the differences between the structural adaptations and nutritional requirements of the two species.

METHODS & MATERIALS

Sampling was conducted in an intertidal swale just inland from Evergreen Beach on Lake Huron in southeastern Presque Isle Co., Michigan (NE ¼ Sec. 21, T36N R4E) on 1 August and 4 August 2000. The swale was dominated by a rich fen comprised of marly soil where populations of *Drosera linearis* thrived. The fen contained scattered *Sphagnum* hummocks covered with *Drosera rotundifolia* and was surrounded by a cedar swamp beach ridge dominated by *Thuja occidentalis*, *Abies balsamea*, *Picea mariana*, *Sphagnum capillifolium*, and *Sphagnum papillosum*.

Samples were taken in relation to a 100-m north/south transect which extended nearly the length of the muddy soil in the bottom of the swale. Five ten-by-ten meter plots were oriented so that they included vegetation present in the marly areas as well as the hummocks and upland edges. Within each plot, I established two one-by-one meter subplots (one for each species). These subplots were chosen arbitrarily to ensure representative sample sizes. Three counts were made for both species within each subplot: 1) number of individuals, 2) total number of leaves and 3) number of leaves containing insects ("insect-leaves"). In addition, 10 insect-leaves were arbitrarily removed from each subplot. In cases where 10 insect-leaves were not present, five were taken instead.

To determine their potential insect-catching surface areas, the dimensions of these leaves were measured. For *D. linearis*, the length was determined as the distance of the leaf blade covered by trichomes and was multiplied by the width in the middle of the leaf to yield the surface area. For *D. rotundifolia*, diameters were measured and surface areas calculated assuming the shape of a leaf to be roughly circular. These values were divided by the average number of insects per insect-leaf for each species to give the average number of insects per mm² and then multiplied by the average leaf area to yield the total number of insects per leaf. To determine the total number of insects per plant, these values were multiplied by the average number of leaves per plant for each species. Using a dissecting scope, I counted the insects on these leaves and identified them to the ordinal level.

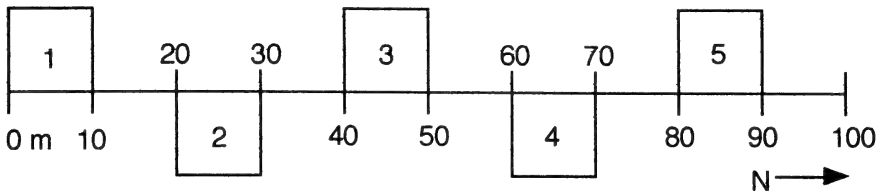


FIGURE 1. Diagram of plots 1-5 on the 100 m North-South transect.

RESULTS

Kruskal-Wallis one-way analyses of variance were used to examine the significance of relationships between *D. linearis* and *D. rotundifolia* in the one square-meter subplots for: 1) the percentage of leaves containing insects (Fig. 1); 2) insects per insect-leaf (Fig. 2); and 3) insects per plant (Fig. 3). *Drosera linearis* plants had significantly larger percentages of leaves that contained insects compared to *D. rotundifolia* plants ($p = 39.8$, $n = 10$). On average, *D. linearis* insect-leaves contained about four times as many insects as those of *D. rotundifolia* ($p = 39.8$, $n = 10$) as well as 14.7 times as many insects per plant ($p = 39.8$, $n = 10$). Insects identified on leaves of both species included members of the orders Diptera, Hymenoptera, and Odonata (Reznik, personal communication).

The average surface area of *D. linearis* insect-leaves was 39 mm² ($n = 27$), compared to 21.2 mm² ($n = 37$) for insect-leaves of *D. rotundifolia*. The average

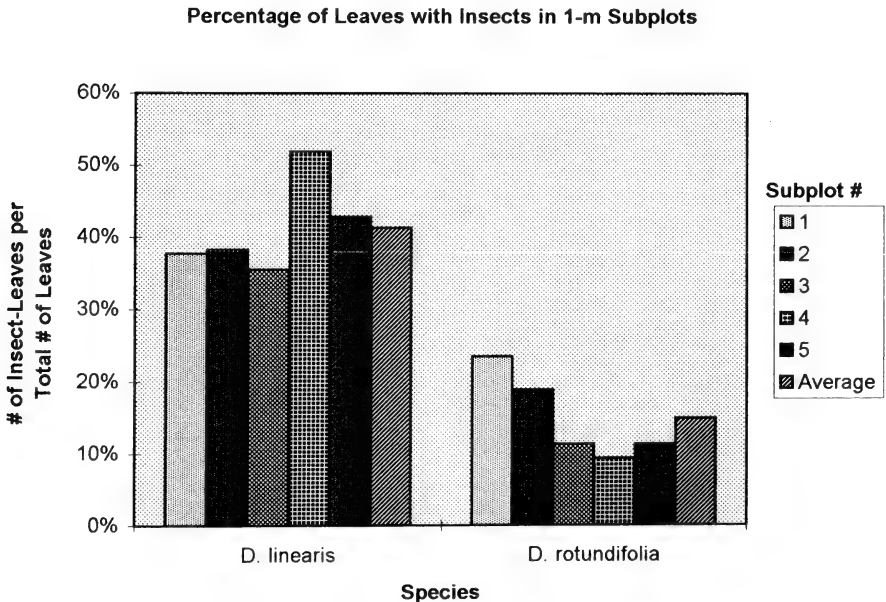


FIGURE 2.

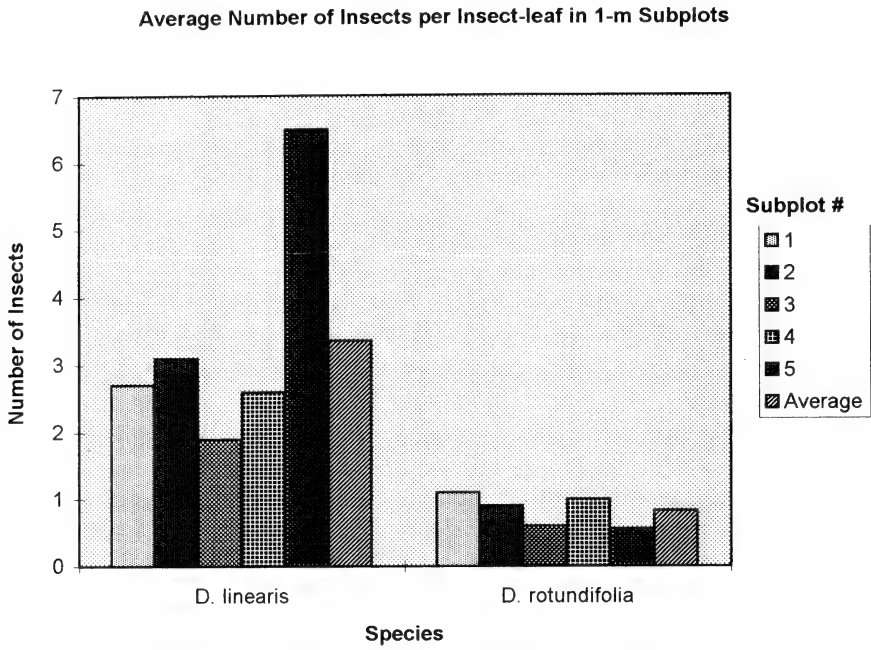


FIGURE 3.

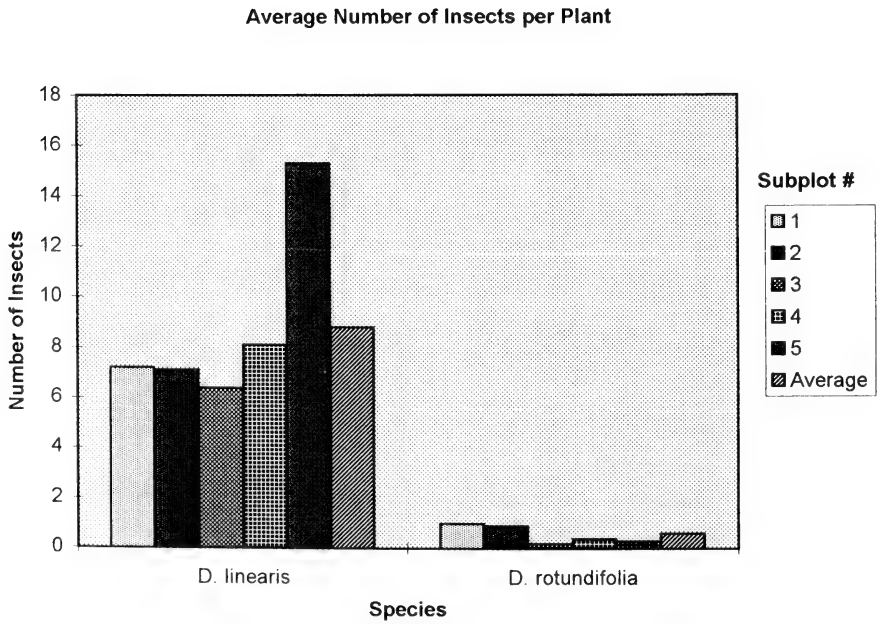


FIGURE 4.

number of insects per mm² on *D. linearis* insect-leaves was 0.087 (n = 27), which was 2.3 times greater than for those of *D. rotundifolia* (0.038; n = 37).

DISCUSSION

Not only did each insect-leaf of *D. linearis* capture more insects than those of *D. rotundifolia*, but *D. linearis* plants also had a larger proportion of leaves containing insects, making *D. linearis* much more efficient at capturing insects on a per-plant basis than *D. rotundifolia*. Even when relative surface areas were considered in calculations, *D. linearis* was still twice as effective.

There are several possible explanations for this relationship. First, it seems that *D. linearis* is structurally better adapted for catching multiple insects on one leaf. This is related to the way that the margins and trichomes of the leaves curl inward around a captured insect. A *D. rotundifolia* leaf curls inward and upward forming a cup-like shape, condensing the leaf and reducing the number of trichomes exposed to capture additional insects (Slack 1979). I observed that *Drosera linearis* leaves pinch in from the sides, their trichomes folding inward in a lateral motion as well as rolling downward from the tip to the petiole, leaving a large portion of trichomes still available to catch additional insects. This is consistent with observations by Bopp and Weber (1981). Leaves of *D. rotundifolia* are therefore adapted to capture only a few insects per leaf at a time, while those of *D. linearis* are better equipped to capture additional insects while still digesting those already captured. Surface area, however, is probably not the best representation of a plant's ability to catch insects. The highest densities of trichomes is around the margins of leaf, not in the middle (Slack 1979). Perhaps a more accurate measure of a leaf's potential insect-capturing area would be margin length or even total number of trichomes.

Second, apart from a small population of *Pinguicula vulgaris* (common butterwort), *D. linearis* had virtually no competition for space in its microhabitat (nutrient-rich, alkali fens). In addition, the vertical orientation of leaves allowed it to capture flying insects easily. In contrast, *D. rotundifolia* was competing for space with many larger species that probably reduced its access to flying insects (especially in rich fens) (Thum 1986). This would limit its prey to insects crawling on the ground (Schulze & Schulze 1990, Thum 1986). At the same time, *D. linearis* would be limited to flying insects, as most crawling insects would not be present in standing or slow moving water (Schulze & Schulze 1990, Thum 1986). In fact, research conducted by Achterberg (1973) and Thum (1986, 1989) comparing the prey of *Drosera rotundifolia* and *Drosera intermedia* demonstrated that flying insects were captured far more often by *D. intermedia* than by *D. rotundifolia* and that the opposite was true for crawling insects. (*Drosera intermedia* is similar to *D. linearis* in its elongated, vertically-oriented leaves and preference for a wet, marly habitat. Because of these similarities, information on *D. intermedia* can be used in this study as analogous data, to compensate for lack of information on *D. linearis*.)

It is reasonable to assume that on the average, crawling insects weigh more than

flying insects. The total number of insects captured is less important than the total biomass of trapped prey; therefore, plants specializing in crawling prey could survive by consuming smaller numbers of insects. The low light conditions around the perimeter of the fen promoted larger leaves in *D. rotundifolia* which could have led to its capture of larger, but fewer insects (Schulze & Schulze 1990). In addition, because of the flattened orientation of its leaf rosettes, *D. rotundifolia* could benefit nutritionally from pollen grains and small leaf fragments which fall to the ground, making the capture of insects less important in supplementing low levels of nitrogen and phosphorus in the soil (Juniper 1989). Thum's studies (1986, 1989) showed that while *D. intermedia* caught an average of 14 times as many insects as *D. rotundifolia* (consistent with the findings of this study for *D. linearis*), the total biomasses of the two species within the study area were equal. This meant that both species exhibited equal prey catching success when plant biomass was accounted for. Although plant biomass was not considered in this study, the same is most likely true for the relationship between *D. rotundifolia* and *D. linearis*. Simply because *D. linearis* captures more insects than *D. rotundifolia*, this does not suggest that *D. linearis* is any better adapted for survival. It must, however, in order to be successful, be better adapted for capturing more insects, because of the smaller size of its accessible prey and its limited access to alternate sources of nitrogen (pollen grains and leaf-fragments).

It should be noted that this study was conducted in a very specific and localized habitat and these results and conclusions may not apply to all areas in which *D. linearis* and *D. rotundifolia* coexist. In order to better understand the relationship between these two species, it is necessary to conduct further research in a variety of habitats, taking into account prey identity, biomass, nutritional value and plant biomass, as well as the length of leaf margins and numbers of trichomes.

ACKNOWLEDGMENTS

Special thanks to Barbara Madsen and Nick Reo for their helpful guidance and suggestions; and thanks to Philip Myers for his statistical advice, and to Joseph Reznik for assisting with the identification of insects.

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***TETRADIMUM DANIELLII* (KOREAN EVODIA; RUTACEAE) AS AN ESCAPE IN NORTH AMERICA**

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Tetradium daniellii (Benn.) T. G. Hartley (Korean evodia, Rutaceae) is native to Tibet and the Yunnan Province, China, northeast through China to North and South Korea (Hartley 1981). The species first came to the attention of western botanists in the mid-1800's, and was first described as a species of the genus *Zanthoxylum* by Bennett (in W.F. Daniell 1862). It was introduced into North America about 1905 (Rehder 1947). In the horticultural trade, the tree has been known as *Evodia daniellii* (Benn.) Hemsl. (Dirr 1997; Nelson 1997), though that generic name is apparently most correctly spelled "*Euodia*", since *Evodia* is considered an orthographic variant of the original spelling *Euodia* (Bean 1978; Mabberley 1997). The genus *Tetradium*, containing 9 species (Flanagan 1988), is probably most closely related to *Phellodendron* Rupr. and *Zanthoxylum* L. (Hartley 1981).

The genus *Tetradium* (as *Evodia*), especially fruit of *T. ruticarpum* (A.Juss.) T.G. Hartley (*Evodiae* Fructus), has been used medicinally in China to treat gastric and intestinal ailments for about 2000 years (Anonymous 2002a). It has also been used to treat headaches, to decrease blood clotting, and to reduce arthritis pain (Anonymous 2002b), and as a stimulant and antihelmintic (Mabberley 1997). Several bioactive alkaloids have recently been characterized from *E. ruticarpa*, and these may have use in treatment of obesity or ulcers (Ko et al. 2002). Fruits of other species have been used in chutney (Mabberley 1997) and other condiments (Daniell 1862). Several species are grown as ornamental trees (Rehder 1947).

Korean evodia (bebe tree, bee-bee tree, bee tree; Fig. 1) is a moderate-sized tree or large shrub, reaching 8–12(–20) m tall, with a similar spread of the crown. Its bark is smooth and gray to black. The young branches are pubescent, becoming glabrous as the growing season progresses; winter buds are naked. Leaves are 22–40 cm long, opposite to subopposite, odd-pinnately compound, with 5–11 leaflets; leaves are deciduous, dropping when green, or turning yellowish in autumn. The leaflets are 5–13 cm long, ovate to oblong, acuminate at the apex and acute to rounded at the base, short-petiolulate, with crenate margins; the upper leaf surface is glabrous, while the lower is somewhat pubescent, at least when young; there are prominent to inconspicuous oil dots on the lower surface. The small white to cream-colored unisexual flowers appear in June to August, and are borne on the current years' growth on 10–17 cm broad, somewhat flattened terminal corymbs. Flowers are usually 5-merous, though occasionally 4-merous; sepals are slightly pubescent, 0.5–1.5 mm long; petals are white to cream colored, glabrous adaxially and somewhat pubescent abaxially,

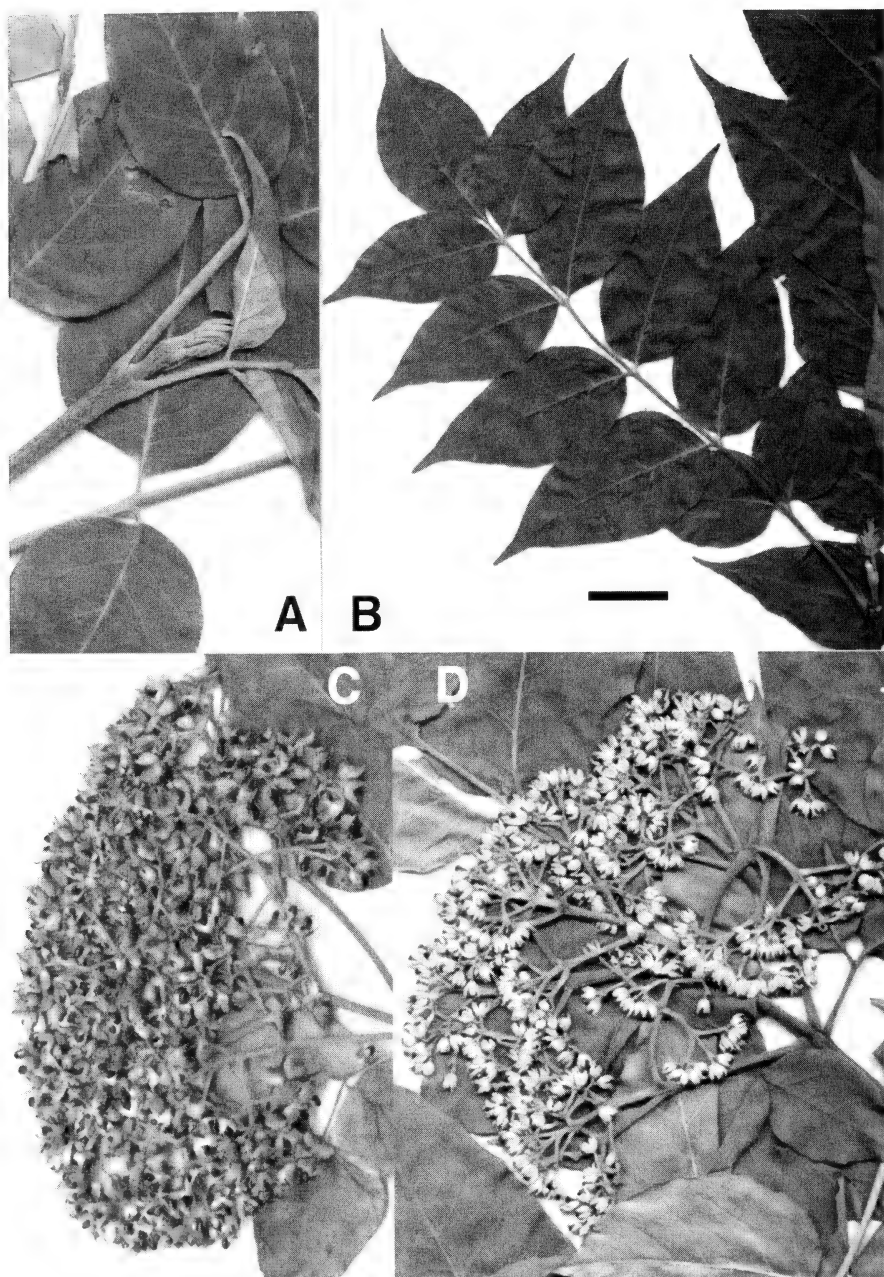


FIGURE 1. *Tetradium daniellii*. A. Young branch with naked terminal bud (Wilson s.n., 8 Oct 2002 [MU]). B. Mature leaf (Wilson s.n., 11 Apr 1986 [MU]). C. Infructescence with open fruits and seeds (Wilson s.n., 7 Oct 1986 [MU]). D. Inflorescence (Vincent 6300 [MU]). The scale bar represents 1 cm for A, and 2 cm for B, C, and D.

3–5 mm long; the pistil is 4–5 carpellate, pubescent, with 2 ovules per carpel; the ovary is superior. Fruits are brown, pinkish, dull red, or black follicles containing 2 brown to black seeds, one of which is usually sterile (Hartley 1981; Sargent 1913).

Tetradium daniellii is highly prized as a nectar source for honeybees (Anonymous 1974; Hayes 1977; Lohmüller 1977; Lovell 1969). Indeed, when the plants are in flower, an incredible number of bees can be seen (and heard) visiting the flowers. Hayes (1977) describes the tree as valuable for beekeepers because it flowers prolifically from mid-July through mid-August, when little else is blooming. The heavy seed production has been cited as a potential food source for wildlife (Hayes 1977). The species is becoming more popular as an ornamental tree (Coombes 1992; Dirr 1997; Gilman & Watson 1993), though it can be susceptible to wind and ice damage due to its weak wood (Flint 1983; Gilman 1997). Propagation is usually by seeds (Dirr 1990). It is relatively tolerant of many soil conditions (Flanagan 1988), but does not tolerate extreme drought or overly wet soils (Schnelle 1992). The species is described as hardy in USDA zones 4 through 8A (Dirr 1997; Gilman & Watson 1993), but Schnelle (1992) reported that freeze damage and die-back have been seen on young trees at Kansas test sites. Korean evodia is a relatively short-lived tree (15–40 years; Dirr 1990; Poor 1997).

In this paper, I present the first report *Tetradium daniellii* as a documented escape from cultivation in Ohio. The plants found (immature saplings ranging from 1–2 m in height) were growing in a weedy fencerow within 20m of a pair of large trees in cultivation, with *Lonicera maackii* (Rupr.) Maxim. There are no previous reports of the species as an escape in Ohio (Cooperrider et al. 2001).

Rhoads & Block (2000) mention that *Euodia daniellii* may be present in Pennsylvania as an escape, in a description of *Euodia hupehensis* Dode. Since *E. hupehensis* has been synonymized with *Tetradium daniellii* in the most recent monograph (Hartley 1981), all Pennsylvania records should be considered the latter. Documentation was seen for two Pennsylvania counties (Lancaster and Montgomery). The species has also been seen as an escape in Bucks County, Pennsylvania, though not documented (T. A. Block, pers. comm.). Korean evodia has recently been reported as an escape in Missouri (Bowe & Redfearn 2002). No other reports are known from the botanical literature for North America, and the species is not listed in Kartesz and Meacham (1999).

As discussed for *Eucommia ulmoides* (Vincent 2002), *Tetradium daniellii* does not seem to be overwhelmingly invasive, though its heavy fruit and seed set make it more likely that it may spread very effectively. In Pennsylvania, the species is spreading rapidly (T. Block, pers. com.). The species has been removed from one botanical garden because of fears of spread, due to the tremendous fruit set (K. Conrad, pers. comm.).

Specimens examined: MISSOURI: Green County, 22 Oct 2002, *Bowe 90-02* (SMS), and 6 Nov 1992, *Bowe 99.02* (SMS). OHIO: Butler County, 8 Oct 2002, *B.B. Wilson s.n.* (MU, MO, NA, OSH). PENNSYLVANIA: Lancaster County, Flourtown, 9 Aug 1996, *A.F. Rhoads & T.A. Block s.n.* (MOAR); Montgomery County, New Danville, 2 Aug 1998, *T.A. Block s.n.* (MOAR).

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A COMPARISON OF PRE-EUROPEAN SETTLEMENT AND PRESENT-DAY FORESTS IN DELTA COUNTY, MICHIGAN

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ABSTRACT

General Land Office (GLO) survey records from 1841–1853 were compared with data collected in 1991–1992 from Forest Inventory and Analysis (FIA) plots to quantify changes in forest species composition in Delta County, northern Michigan. Northern white-cedar (*Thuja occidentalis* L.) was the most common species in 1841–1853 and 1991–1992. It made up 25% of the trees measured in the GLO survey and 27% of the trees measured in the FIA plots. Hemlock (*Tsuga canadensis* (L.) Carr.), tamarack (*Larix laricina* (Du Roi) K. Koch), and yellow birch (*Betula alleghaniensis* Britton) were frequently recorded in pre-European settlement forests, but are much less common in present-day forests. They were replaced as abundant species in the contemporary landscape by aspen (*Populus* spp.), red maple (*Acer rubrum* L.) and balsam fir (*Abies balsamea* (L.) Mill.). The changes observed in species composition most likely resulted from alteration in the type, frequency, and severity of disturbance. As this region became settled by people of European descent, logging, slash fires, and land clearing replaced wind and wildfire as the predominant disturbance regimes. These newer disturbances favored the establishment of early-successional species adapted to frequently disturbed conditions. Human influences also increased the white-tailed deer population, decreased the number of seed sources of some commercially valuable tree species, and suppressed forest fires, all of which contributed to changes in species composition.

INTRODUCTION

Virtually all forested landscapes of the eastern United States have been heavily influenced by human activities over the last century or longer. It is useful to understand how these contemporary forests differ from those that existed prior to the immigration of Europeans. Pre-European forests serve as controls for understanding the impacts of forest management practices (Trombulak 1996), but current efforts to restore stands to these conditions require a “blueprint” of structural and functional characteristics (Lorimer & Frelich 1994).

In the Great Lakes region, three approaches are commonly used to quantitatively reconstruct the composition of pre-European settlement forests. First, pollen grains deposited in lake and bog sediments can be dated and used as

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records of long-term changes in vegetation (Davis 1981). Second, remnant stands of old-growth forest can be studied. In the northern Lake States, approximately 1% of forests remain intact and unlogged (Frelich 1995), and 2% of forests are older than 120 years (Schmidt et al. 1996). Larger tracts of old-growth forests are often the subject of intensive scientific study (Davis et al. 1996; Frelich & Reich 1996; Cook 2000; Stearns & Likens 2002). Third, records of land surveyors can be examined. Federal government surveyors working on the General Land Office (GLO) survey program in the 1840s and 1850s systematically recorded the vegetation of the Lake States prior to extensive European settlement. Their records have been used to describe the forest composition and/or natural disturbance regimes of the mid-19th century (Canham & Loucks 1984; Grimm 1984; Whitney 1986; Leitner et al. 1991; Schaetzl & Brown 1996; Zhang et al. 1999), and to compare these conditions with those of present-day forests (Stearns 1949; Janke et al. 1978; Mladenoff & Howell 1980; Whitney 1987; Palik & Pregitzer 1992a; White & Mladenoff 1994; Van Deelen et al. 1996; Radeloff et al. 1999; Zhang et al. 2000; Copenheaver & Abrams 2002).

Second-growth forests in and around Delta County in Michigan's Upper Peninsula have served as the study area for recent investigations into the dynamics and conservation of northern white-cedar (*Thuja occidentalis* L.) (Heitzman et al. 1997; Heitzman et al. 1999; Van Deelen 1999). For some of these forests, the species composition and disturbance regimes prior to European settlement have also been reported (Van Deelen et al. 1996; Zhang et al. 1999; Zhang et al. 2000). However, no one has used GLO survey records to reconstruct the composition of the forest landscape of the entire county. The objectives of this study were: (1) to compare the species composition in pre-European settlement and present-day forests in Delta County and (2) to describe the influence of human disturbances on the historical development of current forests.

DESCRIPTION AND HISTORY OF THE STUDY AREA

Delta County encompasses 304,848 ha in the south-central portion of Michigan's Upper Peninsula (Figure 1). The regional climate is continental, with noticeable lake influences near Lake Michigan. Summers are cool (average May–September temperature = 14–16°C), and winters are cold and snowy (mean annual snowfall = 140–250 cm). The surface geology of Delta County is characterized by sandy soils on the lake plains, beach ridges, and outwash plains, loamy soils on limestone bedrock and the ground moraines, and organic soils on the former lake beds (Berndt 1977; Albert et al. 1986).

Delta County was influenced by human activities prior to the 1841–1853 GLO survey. Archaeological evidence indicates that Native Americans settled in the county along rivers and Lake Michigan during the Middle or Late Woodland period (about 3000–300 years before present) (Silbernagel et al. 1997). In 1830, the Native American population of the entire Upper Peninsula was estimated to be 1500 persons in 25 villages and fishing sites, including six Ojibwa villages on Lake Michigan in Delta County (Tanner 1987). During the 1840s, surveyors in

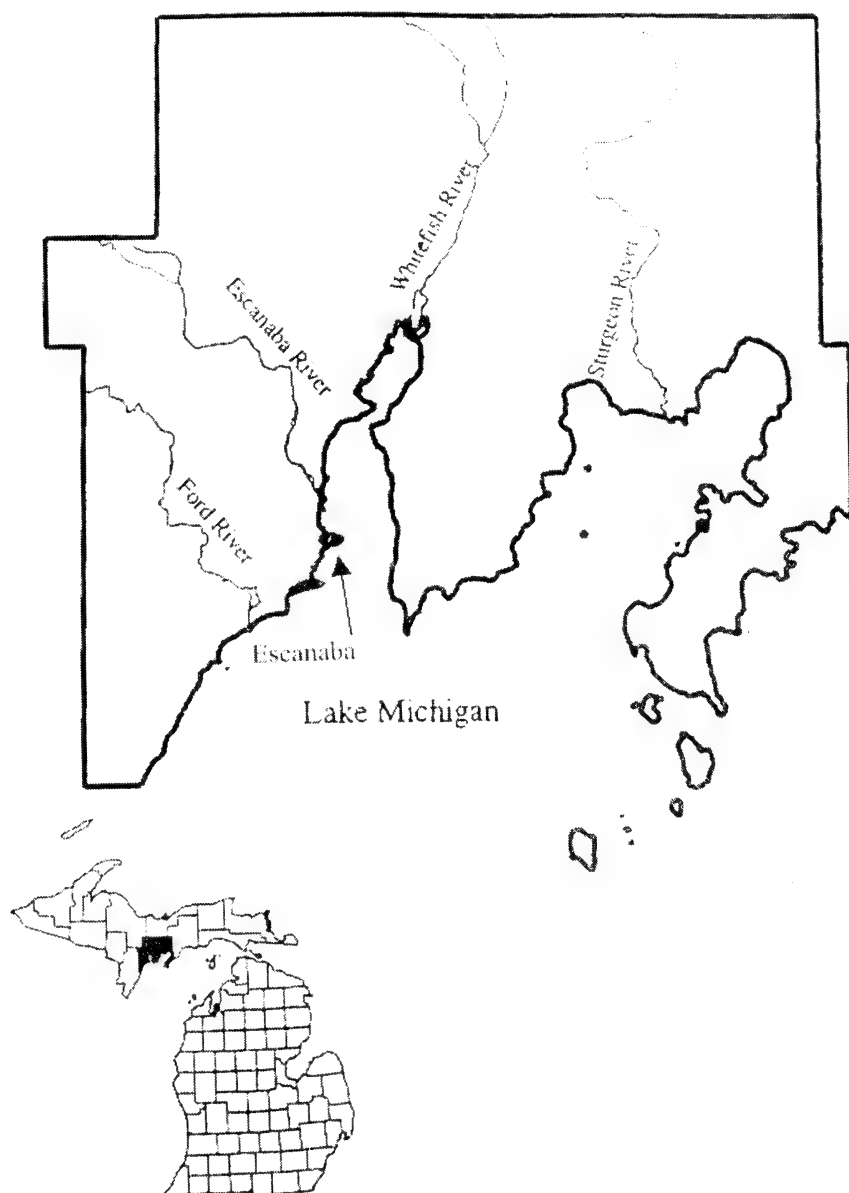


FIGURE 1. Study area of Delta County in Michigan's Upper Peninsula. Included are the city of Escanaba and the rivers on which sawmills were located during 1841-1853.

the county referred in their notes to Native American gardens, sugarbushes, and trails, particularly near rivers and Lake Michigan.

People of European descent also settled in Delta County before the GLO survey. The first white resident recorded in the county settled in what is now

the city of Escanaba in 1830. The first water-powered sawmill was built on the Escanaba River in 1836, and the first steam-powered mill was operating on the river by 1841 (Delta County Historical Museum, Escanaba, Michigan). During the 1840s, additional sawmills were established near the mouths of the Ford, Whitefish, and Sturgeon Rivers (Figure 1). By the time of the first county census in 1860, the regional population was 1172 persons (K. Pregitzer, unpublished data). At this time, Delta County included portions of Menominee and Dickinson Counties to the west and was considerably larger than its present size.

GLO surveyors, particularly along the Escanaba and Ford Rivers, occasionally described the logging practices of the mid-1800s. In 1847, deputy surveyor Algernon Merryweather noted, "On the Escanaba River are also some very fine pines, many of which, however, have been cut to supply the mills near the mouth of the river. As many as six thousand logs remain yet in the river in this town awaiting a (flood) to carry them down." During their field work, surveyors also commented on the signs of past forest fires. Merryweather wrote in 1847, "The fire of last year which has spread over so many towns in this part of the country has burnt over about one-third of this town extending from the east side of the town southwesterly to the Escanaba River." Many fires were located near rivers and lake shorelines. Some of these were probably caused by logging and other human activities.

During the late 1800s and early 1900s, timber was harvested at unprecedented levels throughout the Upper Peninsula, including Delta County. By 1930, few stands remained which had not been logged (Karamanski 1989; Verme 1996). However, in contrast to this era, the landscape described by surveyors during the mid-1800s was only slightly impacted by human activities. This was particularly true of tracts away from Lake Michigan and river corridors.

METHODS

Pre-European settlement forest composition

Delta County includes portions of 42 survey townships. Townships have an area of 9.6×9.6 km and are divided into thirty-six 1.6×1.6 -km squares, or sections. Most of the exterior township lines in the study area were surveyed by William and John Burt in 1841–1846, and most section boundaries were surveyed by Algernon Merryweather between 1847–1853.

For each section, surveyors set a wooden post at the four section corners and four quarter section corners. A quarter section corner is the halfway point (0.8 km) of the line between two section corners. Near each post, surveyors recorded the species and diameter of two trees ("witness trees"). They also recorded the species and diameter of some of the trees that intersected section lines. Four such "line trees" were usually reported for every 1.6 km of section line. In addition, surveyors noted general landscape characteristics, including evidence of past disturbances such as windfalls or burnt land.

The surveyors' records for all 42 townships in Delta County were reviewed to reconstruct the pre-European settlement species composition of the study area. The uses and limitations of GLO survey data in determining pre-European settlement forest composition are discussed by Bourdo (1956), Whitney (1986), Manies et al. (2001), and Schulte & Mladenoff (2001). We calculated the relative frequency for each species by dividing the number of times a species was used as a witness or line tree by the total number of witness and line trees reported ($n=17,183$). We also examined the species composition of witness and line trees that were cited by surveyors as being blown over or growing within windthrows ($n=376$). We define windthrows as portions of lines referred to by surveyors as

“windfall” or having “much”, “considerable”, or “mostly” fallen timber. Line portions and individual trees that had been both blown down and burnt were not considered as windthrows.

Present-day forest composition

State forestry agencies maintain a network of permanent Forest Inventory and Analysis (FIA) plots throughout the United States to describe the forest resources of the country. We used information from the 1991–1992 inventory of FIA plots in Delta County to estimate the present-day forest composition of the study area. The relative frequency of each species was determined from the trees recorded ($n=9,180$) on all 459 plots in the county.

Diameter distributions

We compared the diameter distribution of northern white-cedar trees in 1841–1853 to the diameter distribution of cedar trees in 1991–1992 using a Kolmogorov-Smirnov test (Gibbons 1985). Because surveyors were required to inscribe information such as “T40N R24W S36” onto some witness trees, they preferentially selected larger diameter trees. As Bourdo (1956) noted, “It is very difficult to put that many characters on the round bole of a 4 or 6-inch (10 or 15-cm) tree”. It is likely the majority of trees recorded by surveyors were larger than 18-cm dbh. Therefore, any individuals <18-cm dbh were omitted from our comparison of the two time periods.

RESULTS

Cedar was the most abundant species in 1841–1853 and 1991–1992 (Table 1). It comprised 25% of the witness and line trees in the GLO survey, and 27% of the trees measured in the FIA plots. However, comparisons of other species indicate that the forest composition of Delta County has changed considerably over the past 150 years. During pre-European settlement times, hemlock

TABLE 1. Relative frequency of all tree species in pre-European settlement and present-day forests in Delta County, Michigan

Species	Pre-European settlement (1841–1853)	Present-day (1991–1992)
	(%)	(%)
<i>Thuja occidentalis</i>	25	27
<i>Tsuga canadensis</i>	13	3
<i>Larix laricina</i>	11	1
<i>Betula alleghaniensis</i>	9	1
<i>Acer saccharum</i>	7	7
<i>Picea</i> spp.	7	5
<i>Abies balsamea</i>	6	10
<i>Pinus resinosa</i>	4	5
<i>Pinus strobus</i>	4	1
<i>Populus</i> spp.	3	12
<i>Fagus grandifolia</i>	3	1
<i>Acer rubrum</i>	2	11
<i>Pinus banksiana</i>	2	3
<i>Fraxinus nigra</i>	1	3
<i>Betula papyrifera</i>	1	5
Other species	2	3

TABLE 2. Relative frequency of all tree species that were blown over or growing in windthrows in pre-European settlement forests in Delta County, Michigan

Species	Pre-European settlement
	(1841-1853) %
<i>Thuja occidentalis</i>	30
<i>Larix laricina</i>	13
<i>Tsuga canadensis</i>	10
<i>Picea</i> spp.	10
<i>Abies balsamea</i>	9
<i>Populus</i> spp.	8
<i>Betula alleghaniensis</i>	6
<i>Betula papyrifera</i>	3
<i>Fraxinus nigra</i>	3
<i>Acer rubrum</i>	3
<i>Pinus</i> spp.	3
<i>Fagus grandifolia</i>	2
Other species	1

(*Tsuga canadensis* (L.) Carr.), tamarack (*Larix laricina* (Du Roi) K. Koch), and yellow birch (*Betula alleghaniensis* Britton) were the most commonly recorded species after cedar (Table 1), making up 33% of the trees reported. By 1991–1992, aspen (*Populus tremuloides* Michx., *P. grandidentata* Michx. and *P. balsamifera* L.), red maple (*Acer rubrum* L.), and balsam fir (*Abies balsamea* (L.) Mill.) had replaced them as the most abundant species after cedar, comprising 33% of the trees on the FIA plots. Hemlock, tamarack and yellow birch declined in importance and only made up 5% of the trees measured in 1991–1992 (Table 1).

In the pre-European settlement forest, cedar was the species most commonly associated with areas disturbed by wind (Table 2). Thirty percent of trees that were blown down or found growing in windthrows were cedar. Along with cedar, five other genera comprised 80% of the trees associated with wind damage. These included tamarack, hemlock, white and black spruce (*Picea glauca* (Moench) Voss and *P. mariana* (Mill.) B.S.P.), balsam fir, and aspen. White, red, and jack pines (*Pinus strobus* L., *P. resinosa* Ait., and *P. banksiana* Lamb.) and mesic hardwoods like beech (*Fagus grandifolia* Ehrh.) were rarely blown over or found growing in windthrows (Table 2).

There was a significant difference ($P < 0.001$) between the diameter distributions of northern white-cedar trees in 1841–1853 and 1991–1992. Cedar trees in pre-European settlement forests were generally larger in diameter than cedar trees in present-day forests (Figure 2). Surveyors in the mid-1800s reported a greater proportion of large diameter cedar and a lesser proportion of small diameter cedar than were measured in FIA plots. Twenty-three percent of pre-European settlement cedar exceeded 30-cm dbh, whereas only 5% of today's cedar exceeded this diameter.

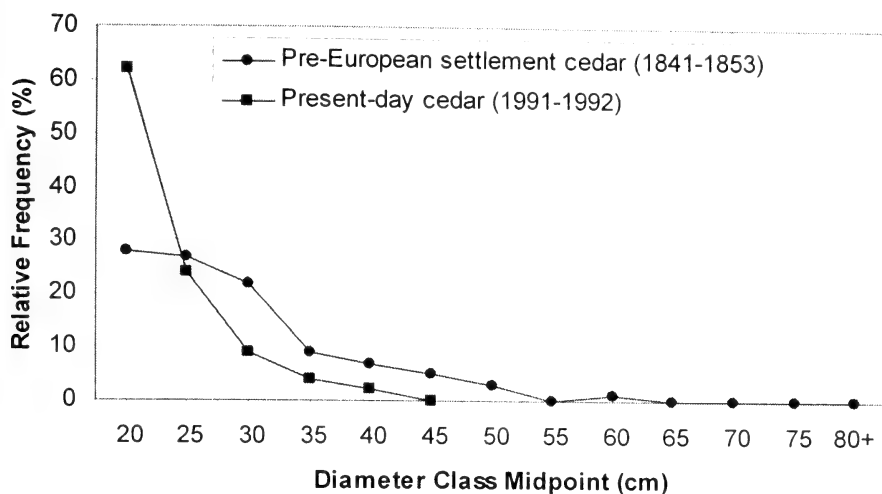


FIGURE 2. Comparison of pre-European settlement and present-day diameter distributions of northern white-cedar trees >18-cm dbh in Delta County, Michigan.

DISCUSSION

Species abundance patterns

In some ways, the forests of Delta County have not changed appreciably over the past 150 years. The same species were reported in the county during the mid-1800s and early 1990s (Table 1). Also, northern white-cedar was the most abundant species during both measurement periods (Table 1). However, the relative frequency with which some species occur has substantially changed. Hemlock, tamarack and yellow birch are found much less commonly now than during pre-European settlement times. In contrast, aspen, red maple and balsam fir were uncommonly recorded during the GLO survey, but are the most abundant species (after cedar) in the contemporary landscape (Table 1). Similar findings have been reported in Wisconsin and elsewhere in Michigan (Janke et al. 1978; Mladenoff & Howell 1980; Whitney 1987; Palik & Pregitzer 1992a; White & Mladenoff 1994; Van Deelen et al. 1996; Radeloff et al. 1999; Zhang et al. 2000; Copenheaver and Abrams 2002).

Pre-European settlement disturbances

What accounts for these observed changes in species composition? Sprugel (1991) defined an equilibrium landscape as one in which species composition (or some other parameter of interest) is more or less constant over time when averaged over the entire landscape. Under this definition, the vegetation of Delta County is not in equilibrium when comparing the forests of 1841–1853 and 1991–1992. Vegetational disequilibrium can result from: (1) a unidirectional change in climate; (2) a change in the predominant disturbance regime(s); and

(3) a change in species availability (which can be influenced by changes in climate or disturbance regimes) (Delcourt & Delcourt 1987). Because there is no long-term meteorological record of Delta County, we cannot exclude the possibility that the differences in species composition between pre-European settlement and present-day forests were caused, in part, by climatic changes. However, we suggest that the changes observed were caused chiefly by the alteration of disturbance regimes following the settlement of Delta County by people of European descent.

A number of investigators have proposed that fire and wind were the two major types of disturbance regime that occurred in the pre-European settlement forests of the Lake States (Heinselman 1973; Whitney 1986; Whitney 1987; Whitney 1994; Palik & Pregitzer 1992a; Frelich 1995; Zhang et al. 1999; Bonnicksen 2000; Frelich 2002). Fires occurred primarily in pine-dominated forests; there, rotation periods were relatively short (50–200 years) (Whitney 1986; Frelich 1995). We were unable to ascertain the historical role of fire in the pre-European settlement forests of Delta County. The areas of burned land recorded by surveyors may have resulted from fires associated with early European timber harvesting and are not necessarily indicative of the natural disturbance regime. However, the fact that *Pinus* comprised 10% of the witness and line trees in Delta County (Table 1) suggests that fire was of some importance. Pines are believed to have been maintained by fires that reduced hardwood competition and exposed a mineral seedbed for new pine establishment (Heinselman 1973; Whitney 1986; Whitney 1987; Palik & Pregitzer 1992a).

In contrast to the short rotation period of fire, catastrophic windthrow in pre-European settlement forests of the Lake States occurred at rotation periods exceeding 1000 years (Whitney 1986; Whitney 1994; Frelich 1995). In Delta County, surveyors indicated that northern white-cedar and other “swamp conifers” were blown over or growing in windthrows more frequently than other species (Table 2). Because cedar and its associates commonly grow on poorly-drained sites, their shallow rooting habits probably made them more susceptible to wind damage. However, cedar is particularly well-adapted to wind disturbance (Curtis 1946; Nelson 1951; Christensen et al. 1959). When a cedar tree blows over, a large percentage of the root system may remain in the soil. Branches on the upper surface of the trunk are able to grow vertically and form a line of vegetatively produced stems. Nelson (1951) called this process “layering from windthrow”. We caution that it should not be concluded from our results that wind was the most important type of disturbance in conifer swamps.

Changes in disturbance regimes

The importance of fire and wind in shaping the forest composition of Delta County was altered following settlement by European immigrants. After 1830, human activities such as logging, slash burning, land clearing for agriculture, and subsequent fire suppression became the primary forces of landscape change (Mladenoff & Howell 1980; Whitney 1987; Karamanski 1989; White & Mladenoff 1994; Whitney 1994; Verme 1996). Consequently, disturbances in most forest types have become more frequent than during pre-European settlement times and have resulted in: (1) changes in forest composition; (2) an increase in the

population of white-tailed deer (*Odocoileus virginianus*); (3) the reduction of local seed sources; and (4) an alteration in fire regimes.

Forest composition has been significantly altered by human-caused changes in the frequency of disturbance. These frequent disturbances lead to early-successional conditions that favor species such as aspen, red maple, and paper birch (*Betula papyrifera* Marsh.) (Table 1). The relative frequencies of these species increased over fourfold from 1841–1853 to 1991–1992. Aspen and paper birch seeds germinate readily in heavily logged areas and on abandoned farmland, while aspen and red maple sprout vigorously from roots or stumps after cutting or burning. However, requirements for optimal growth of hemlock and yellow birch—which include moist seedbeds of mixed humus and mineral soil or well-decomposed woody debris, a partial canopy to protect young trees from sunlight, and little competition from other trees and shrubs—are not favored by frequent disturbances (Tubbs 1969; Coffman 1978; Hix & Barnes 1984; Erdmann 1990; Godman & Lancaster 1990).

White-tailed deer in Delta County have benefited from the cutting and forest management practices over the last century. Such disturbances have increased the amount of forest edge and provided excellent habitat for deer. Except for a brief period in the early 1900s, deer populations in Michigan have been consistently higher than during pre-European settlement times (Langenau 1994; Van Deelen et al. 1996; Verme 1996). Deer browsing has been implicated as a cause of hemlock decline in the Lake States (Anderson & Loucks 1979; Frelich & Lorimer 1985; Alverson et al. 1988; Rooney et al. 2000); yellow birch is also sensitive to browsing (Erdmann 1990).

Local seed sources of commercially valuable species were probably reduced by selective timber harvesting followed by destructive forest fires at the turn of the century. For example, changes in the number of pine seed trees that survived logging and wildfires resulted in shifts in species composition on former pine-dominated sites in Michigan (Whitney 1987; Palik & Pregitzer 1992a; Palik & Pregitzer 1994). Elimination of seed sources may also be an important factor contributing to hemlock decline (Mladenoff & Stearns 1993). In addition, the exploitation of tamarack stands for mining timbers in the late 1800s and early 1900s may have reduced the availability of seed and lead to the species' decline (Table 1). However, tamarack is also susceptible to periodic destructive epidemics of the larch sawfly (*Pristiphora erichsonii*) (Johnston 1990; Girardin et al. 2002).

Until the early 20th century, human-caused forest fires frequently burned in the slash left after logging, particularly on cut-over pine forests. A program of forest protection beginning in Michigan in the 1920s (Whitney 1987) succeeded in reducing the incidence of wildfire in all forest types. Fire suppression is thought to lead to a greater abundance of red maple on dry-mesic sites in the Lake States (Nowacki et al. 1990; Palik & Pregitzer 1992b), and may be responsible for the increases we observed in red maple in Delta County (Table 1).

FUTURE CHANGES

Northern white-cedar was abundant both in pre-European settlement and present-day forests (Table 1). Our results differ from those of Jackson et al. (2000), who found significant reductions in cedar from 1857 to 1981–1995 in central Ontario, perhaps because of contemporary clearcutting. In Delta County, cedar trees in the pre-European settlement era were generally larger in diameter, and presumably older, than today's trees (Figure 2). The relatively large size of the cedar trees described by surveyors indicates that disturbances that affected cedar prior to the mid-1800s occurred at less frequent intervals than the time elapsed since present-day stands were disturbed.

Disturbance regimes associated with cedar in 1841–1853 included windthrow (Table 2) and perhaps fire. Yet cedar can also aggressively colonize harvested areas by a combination of wind-disseminated seeds and advance regeneration (Verme & Johnston 1986; Heitzman et al. 1997; Heitzman et al. 1999). After establishment, cedar is slower-growing and longer-lived than most associated species. Cedar's ability to reproduce vegetatively and by seed, and its interesting mixture of early- and late-successional life-history attributes, have allowed it to respond successfully to disturbances of different types and frequencies over the past 150 years. However, chronic deer browsing throughout the Upper Great Lakes region is significantly reducing the recruitment of cedar seedlings and saplings (Van Deelen 1999; Cornett et al. 2000; Rooney et al. 2002). Without reductions in deer density, it seems inevitable that the proportion of cedar will decrease, and that the forests of Delta County will continue to change.

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THE BIG TREES OF MICHIGAN

35. *Fraxinus profunda* Bush ex Britton Pumpkin Ash

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The largest known Pumpkin Ash in Michigan is located on Belle Isle, an island in the Detroit River, located just south of the city of Detroit in Wayne County of Michigan's lower peninsula.

Description of the Species: The Pumpkin Ash is a member of the genus *Fraxinus* in the family Oleaceae. In some treatments it is known as *Fraxinus tomentosa* Michaux f., an illegitimate name because the younger Michaux cited previously published names in synonymy—his name was a deliberate substitution. It has opposite, pinnately compound leaves (see Fig. 1). When the young leaves unfold, the blades and petioles are covered with a hoary tomentum. At maturity, the leaflets are covered with a silky pubescence below. The flowers are small and borne in panicles in the spring. Most species of ashes are dioecious. The fruit is a prominently winged samara. Unlike the maples which have double samaras, the fruit of an ash is always single.

An outstanding characteristic of the Pumpkin Ash is the large size of its samaras. They are usually several cm long \times 10 mm wide, substantially larger than the samaras of other ashes. McCormick, Bissel & Stein (1995) provide an illustration of the gradation from the smallest samara (*F. americana*) through *F. nigra*, *F. pennsylvanica* and *F. quadrangulata* to the largest (*F. profunda*). The samaras of *F. profunda* persist in the leaf litter for more than a year and are usually not difficult to find under the trees. These authors also provided a convincing demonstration that the Pumpkin Ash is more common in Ohio than previously thought. Its range extends along the coastal plain from southern New Jersey south to Florida and west to Louisiana. It is also known in the Mississippi Valley as far north as Illinois and "... along the Ohio and Wabash Rivers to Indiana, Ohio, and southern Michigan." Finally, they cite a specimen collected in Hillsdale County Michigan in 1992. Voss (1996) cites an additional specimen collected in Berrien County, Michigan in 1994.

Location of Michigan's Big Tree: The Pumpkin Ash trees on Belle Isle grow in the wooded NE part of the island between the Zoo and the Nature Center. The State Champion tree is in a grove with Shumard Oaks. The grove is located along the Nashua Canal just east of the western bridge of the bicycle trail which runs along the canal.

To reach the tree, take I-75 south through the City of Detroit to I-375. Follow I-375 south to Jefferson Ave. Exit I-375 onto Jefferson Ave. and go east to E.



FIGURE 1. Documented Michigan distribution and characteristics of the Pumpkin Ash. The map is from Voss (1996). The asterisk indicates the location of Michigan's Champion tree. The illustration ($\times \frac{1}{5}$) is from Sargent 1922. Note that the flower clusters are borne opposite one another, as are the young leaves.

Grand Blvd. Turn right and proceed over the McArthur Bridge onto Belle Isle. As soon as you are on the island, the road forks. Take the left fork and proceed along Central Avenue to the intersection with Inselruhe Avenue. Turn right onto Inselruhe Avenue. Go one block and turn left onto Loiter Way. Follow Loiter Way until you come to a curve and then a small bridge. Park on the left and walk down the bike trail over the nearby bridge. Once you have crossed the canal, leave the paved path and turn right along the canal. Proceed about 60 yards. The Champion Pumpkin Ash is on your right about 23 yards back. It is slightly behind and to the right of a large Bur Oak.

Description of Michigan's Big Tree: There are a number of Pumpkin Ash growing with Shumard Oaks in what might be described as a Pumpkin Ash–Shumard Oak Association. These trees were previously visited by Herb Wagner, Steve Koblarz, Susan Campbell, and Bill Brodovich who all agreed that they were, indeed, Pumpkin Ash trees. The State Champion tree was measured by Susan Campbell and Elwood B. Ehrle on 10 July 2001. Its girth at $4\frac{1}{2}'$ above the

ground was 85" (7'1" or 3.3 m). The tree is 135' high (38 m) and has an average crown spread of 50' (15.2 m). The tree is healthy and has a solid straight trunk.

INVITATION TO PARTICIPATE

If you would like to join us in extending this series of articles by visiting and describing one or more of Michigan's Champion trees, please contact Elwood B. Ehrle for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property.

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A REANALYSIS OF 1960S MICHIGAN OLD-FIELD DATA

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ABSTRACT

Data were collected from four old-field areas on the grounds of the Matthaei Botanical Gardens, Ann Arbor, Washtenaw County, Michigan, as part of a dissertation research project. Four different sites were studied, with different treatments applied to each site: control, clipping, deep-tilling, scalping, and manuring with clipping. The data were originally collected in the early 1960s and were originally presented in differential tables. We have reanalyzed these data using detrended correspondence analysis, an ordination technique.

Although the four sites were geographically fairly close to one another, they differed in site conditions and species composition. The first ordination axis separated sites on the basis of moisture availability. There were relatively few differences between the different treatments, with deep-tilling showing the greatest influence on species composition, possibly because the tilling treatment brought buried seeds to the surface and allowed their germination. The individual sites differed significantly in species richness. Among treatments, the control treatment had a significantly higher species richness than most other treatments but was not statistically significantly greater than the deeptilled treatment. Environmental differences were the major factors affecting species composition, with treatments having less of an effect.

INTRODUCTION

There may be a wealth of ecological data that have been collected in dissertations or theses in the past that have not been analyzed and published. These data are still valid, and in some cases represent sites that no longer exist. These data can be reanalyzed using more modern methods.

We are presenting a reanalysis and interpretation of Michigan old-field data collected by one of the authors (GAC) in the early 1960s as part of dissertation research. These data were originally presented in differential tables (following the methods of Braun-Blanquet 1932), but were never published. In 2002, we abstracted the field data from the dissertation. These data were reanalyzed using Detrended Correspondence Analysis (Gauch 1982).

Old fields have long been studied as a model for examining secondary succession, community assembly, and competitive interactions among plants (e.g., Maycock and Guzikowa 1984). Succession is a complex process involving interactions between plant species, the abiotic environment, and other species (e.g., herbivores). Initially, succession was thought to follow a consistent and deterministic pattern (e.g., Clements 1916), or to follow one of several possible pathways (Connell and Slatyer 1977), but more recent reviews have suggested

that there may be elements of facilitation, tolerance, and inhibition (*sensu* Connell and Slatyer 1977) in each succession, with the different patterns representing different species interactions (Pickett et al. 1987) or differences in site conditions.

Succession includes a wide variety of effects and interactions, and is a more complex process than originally thought. Factors that can affect species composition of a site include seed size and amount of litter present (Facelli and Pickett 1991, Reader 1993), soil characteristics (Wilson and Tilman 1993, Baer et al 2003), herbivore activity (Carson and Root 2000), and site history or "abandonment patterns" (Myser and Pickett 1994).

Old fields have long been used as study sites. They are widespread and easily accessed, and succession proceeds more rapidly than on some other sites. One of the characteristics typical of old fields is a high abundance of non-native (usually Eurasian introductions) agricultural weeds in the flora (Maycock and Guzikowa 1984). Michigan has experienced these introductions, as it is in the hay and dairy region of the United States. The naturalization of certain introduced forage crop species has affected the composition of grassland and old-field communities. The most important species introduced into the region during the period of early agricultural development were *Melilotus alba* (white sweet clover), *Melilotus officinalis* (yellow sweet clover), *Trifolium pratense* (red clover), *T. hybridum* (alsike clover), *T. repens* (white clover), *Phleum pratense* (timothy), *Poa pratensis* (Kentucky bluegrass), *P. compressa* (Canada bluegrass), and *Agrostis alba* (redtop) (Klages 1942, Wheeler 1950).

Many of these forage species were present on the Michigan plots studied as part of this research. The sites studied were former farm fields with varied histories. Beckwith (1954) observed that early stages of secondary succession on former agricultural land in Michigan were strongly influenced by the last crop planted, with lesser influences from soil and fire history of the site.

A general pattern described by Beckwith (1954) for Michigan old-field succession is an annual-biennial stage, followed by a perennial grass stage, followed by a mixed herbaceous perennial stage, a shrub stage, and a shade-intolerant tree stage. Hayfields showed a slower progression than crop fields, perhaps because there was a grass community already established. Pickett et al (1987) suggest that competitive inhibition may be a major factor affecting succession in old fields, and that disturbance can "break the hold" that a group of species has on the site and allow for new invasions. In this study, we examine the effects of different sites and treatments on the change in species composition over a three-year period.

MATERIALS AND METHODS

Field sites

The research sites were located on the grounds of the Matthaei Botanical Garden, Ann Arbor, Washtenaw County. Four different sites were located within the grounds of the Botanical Garden (see figure 1 for map of the Matthaei Botanical Gardens and site locations contemporaneous with the time of sampling). Each of the sites differed slightly in site history and species initially present. However, extensive site histories were not available or were not collected; we are presenting the available information on site-history here.

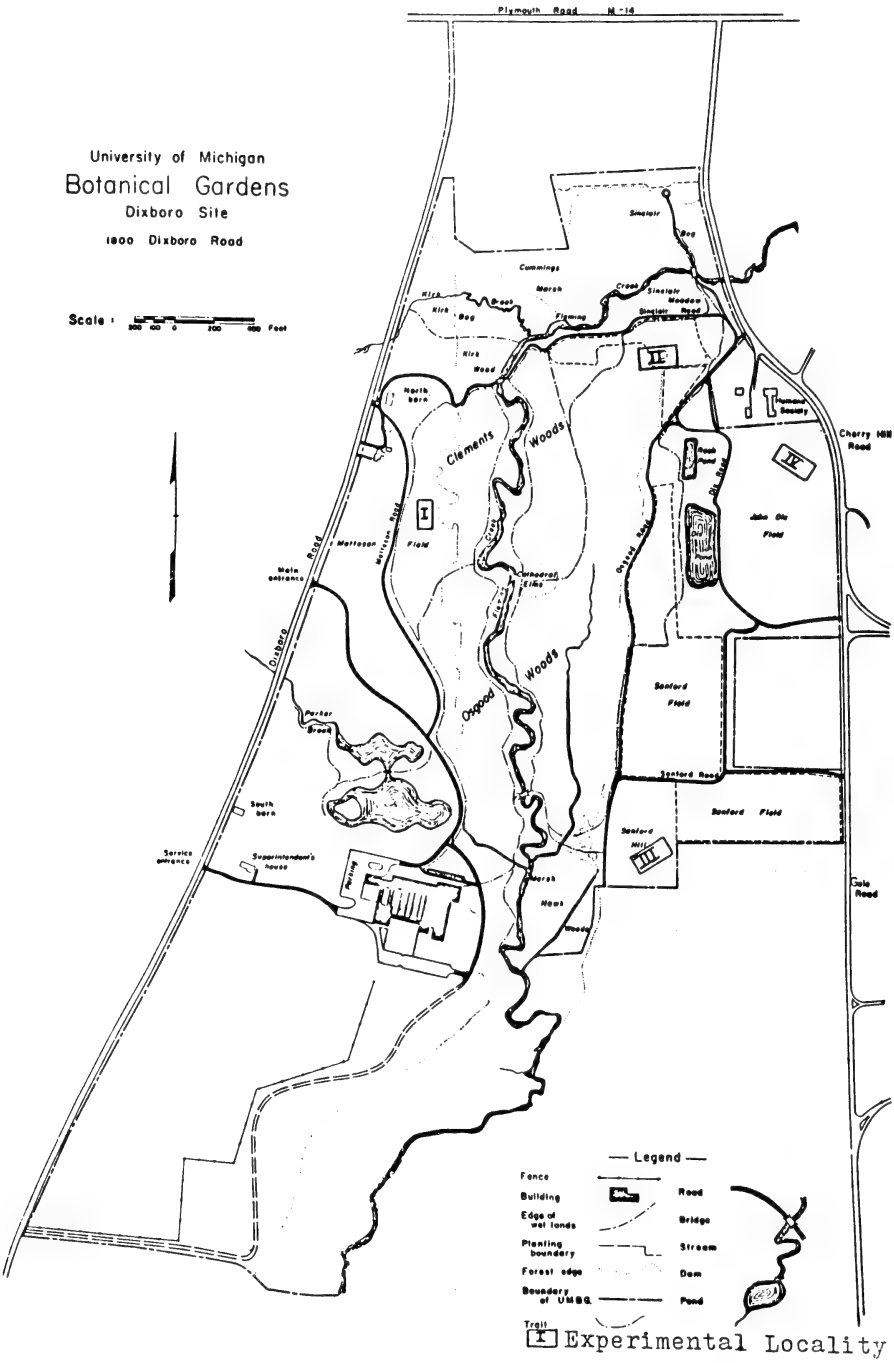


FIGURE 1: Map of Matthaei Botanical Gardens showing locations of the four sample sites. Map shows conditions ca. 1962.

Site 1 (referred to as Matteson Field in the dissertation) was first occupied in 1824 and was farmed extensively until the land was deeded to the University of Michigan. Unfortunately, no data are available on the exact date of abandonment and on the types of crops previously grown there. The site had "imperfectly drained" soils of the Matherton Sandy Loam series and a maximum slope of 2%. Before treatments were applied, the most abundant species were *Phleum pratense*, *Trifolium pratense*, *Plantago lanceolata*, *Potentilla recta*, and *Cerastium vulgatum*.

Site 2 was located in an embayment of grassland in a conifer plantation in the northeast portion of the Matthaei Botanical Gardens. Soils on this site were similar to those of site 1, but perhaps with better drainage. This site was smaller than the others in this study, and only the clipped, control, and deep-tilled treatments were applied. Additionally, this site was destroyed before the completion of research. Before treatments were applied, the most abundant species were *Sonchus arvensis*, *Poa compressa*, *Solidago canadensis*, and *Daucus carota*.

Site 3 was located in the southeastern portion of the Garden in an area known as Sanford Hill. The soil on this site was described as "well-drained" and was a Boyer Sandy Loam. Slopes on this site ranged from 6% to 12% and these soils were known to be susceptible to erosion. Experimental plots were located near the top of a small rise parallel to the contour of the hill. Before treatments were applied, *Agropyron repens* and *Tragopogon major* were the dominant species.

Site 4 was located in John Dix Field in the eastern part of the Botanical Gardens. This site was excavated for sand and gravel prior to the original study, which probably altered the soil profile. Slopes in this area were around 7%. Before treatments were applied, the most abundant species were *Bromus tectorum*, *Melilotus officinalis*, *Ambrosia artemisiifolia*, *Plantago lanceolata*, and *Arenaria serpyllifolia*.

All of these fields had been mowed at least once each growing season for more than ten years prior to the study, but the precise number of years is not known. During the study, mowing of vegetation in the areas surrounding the experimental plots was continued.

Within each of the four sites, different treatments were applied (see figure 2). The treatments included a control (no treatment applied), deep-tilling (sites were tilled once and then allowed to recover), clipping (sites were clipped yearly), scalping (sites were scalped on a yearly basis), and manuring with clipping (sites were treated yearly).

In the control quadrats, the vegetation was left undisturbed. Actually, the control quadrats did constitute another experimental treatment because the fields in which the experimental quadrats were located had been mowed once or twice annually for a number of years prior to the beginning of the research project.

The deep-tilling treatment consisted of spading the soil to a depth of approximately 20 cm (8 inches) with a shovel. The vegetation was completely turned under. This treatment was carried out only once, in the summer of 1961, whereas the other treatments were performed twice in 1961 and once in 1962.

In the clipped quadrats, vegetation was cut to a height of approximately 6.35 cm (2.5 inches) using a pair of garden shears. The clippings were left on the plot. This treatment was done to simulate mowing and, because the experimental study had been mowed at least annually for a number of years, this was actually similar to the previous management practices.

Quadrats subjected to scalping were completely denuded of green shoots and litter with a sharpened trowel. The aerial parts of vascular plants, including stolons, were severed at the soil level, leaving the root systems intact. The aboveground biomass was removed from the quadrats. This process disturbed the soil surface.

The quadrats subjected to the manuring and clipping treatment had vegetation clipped to about 3.8 cm (1.5 inches) using garden shears. The clippings were removed from the site and 500 grams of sterilized cow manure were spread evenly on each of these quadrats. This treatment was designed to simulate grazing effects.

The use of clipped quadrats to simulate grazing is subject to certain limitations: 1) clipped vegetation is cut uniformly at a certain height, whereas livestock pull and break off some of the shoots, 2) livestock are selective in what they eat, and some plants are left untouched, and 3) the species they prefer are often eaten to a height of 2 to 4 centimeters, whereas other species will be less damaged (Culley et al. 1933). In addition to these factors, the trampling by hooves increases the amount of disturbance in natural pastureland. Despite these restrictions, it has been shown that such simulation of grazing provides useful results when compared with actual pastureland (Aldous 1930).

The area set aside for sampling was 1 m wide by 10 m long (site 2) or 20 m long (all other sites).

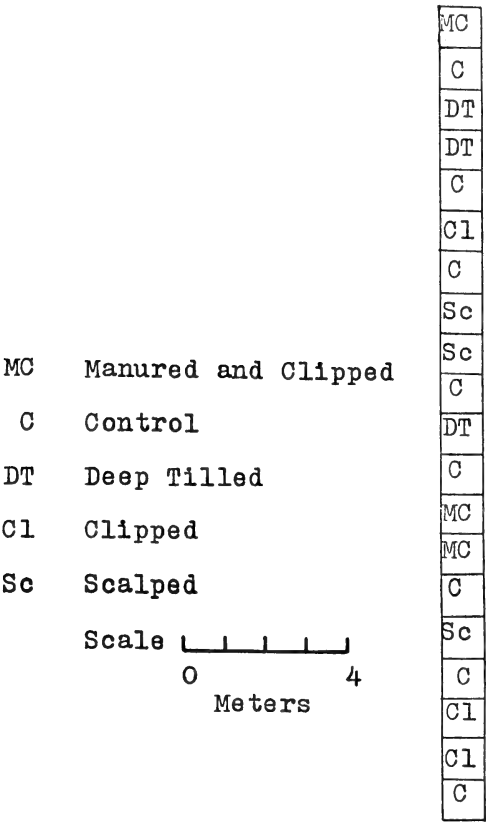


FIGURE 2: Diagram of experimental treatment layout.

Treatments were assigned randomly. Each treatment plot was separated by a control plot, and treatments were assigned such that no two replicates of the same treatment were on either side of a control plot (figure 2). Sites 1, 3, and 4 had all treatments applied; site 2 was smaller and had only clipping and deep-tilling treatments.

Experimental plots were established as either 1 m² or 2 m² areas. The larger plots were initially used to test for edge effects: in the center of these plots, a 1.6 m by 0.6 m area was marked off and sampled after the initial application of treatments. No edge effects could be detected, so both the larger and smaller plots were used in later samples.

Data collection

Each site was sampled during each month of the growing season in 1960, 1961, and 1962. A one-meter square quadrat was used to collect samples from each of the twenty (ten, for site 2) one-meter square plots. Data were collected on abundance and sociability following the methods of Braun-Blanquet (1932); for the current analysis, the abundance data were converted to percent relative frequency based on occurrence in quadrats.

Data analysis

Data given here were abstracted from the dissertation (Corbett 1967). These data represented numbers of occurrences per site per sampling date, and so were easily converted to relative fre-

quency. Relative frequency was computed as the total number of occurrences of a species at a site on a particular date divided by all occurrences of all species on that site on that date. Values were then converted to a percent. These data were entered into a database (a Lotus-style, .wk1 database generated using Microsoft Excel) for data analysis. The computer package PC-ORD (McCune and Mefford 1997) was used to analyze data.

We used detrended correspondence analysis to examine patterns in the data. Detrended correspondence analysis is a multivariate analysis technique. It is a form of ordination which examines the abundance of all species at all sites simultaneously (Gauch 1982). The end result of detrended correspondence analysis is that sites are arranged in "ecological space" based on similarities in species composition. The ordination diagram that results shows the relationships between sites. The sites may form a continuum that represents an environmental gradient (ter Braak and Prentice 1988). It is then up to the researcher to interpret the results.

We chose this method of analysis for several reasons. First, a multivariate technique is capable of examining a large number of independent variables (sites, treatments, sampling dates) and response variables (species relative frequencies) simultaneously. Of the various ordination techniques available, we chose detrended correspondence analysis because it is known to work well on field data and is effective where there may be long environmental gradients (Peet et al. 1988).

Information that can also be calculated from these data are measures of species richness (s , the number of species per sample), Shannon diversity (calculated as $-\sum(p_i \ln p_i)$) and evenness (Shannon diversity/ $\ln(s)$, where $\ln(s)$ is the maximal Shannon diversity possible). These values were calculated for each sample using the "summary" function of PC-Ord (McCune and Mefford 1997). We statistically tested the effect of site and treatment on species richness at the sites. However, the data were not normal (and could not be made normal by transformation), so it was necessary to conduct nonparametric tests on the data. We used the JMP version 5.0 statistics program (SAS Institute 2002). There was no option for a two-way nonparametric analysis of variance in JMP. Instead, we used Kruskal-Wallis to test site and treatment effects separately. We did test for the presence of an interaction using a standard, parametric two-way ANOVA and found no interaction. We performed follow-up tests for the analyses of variance using standard parametric methods (the Tukey-Kramer "honestly significant difference" test). This is not an ideal technique. However, few good non parametric multiple comparison tests exist and they are not available in many standard statistical packages, including JMP (S. A. Juliano, pers. comm., 2003).

RESULTS

When we examined an analysis of all sites together, we observed a separation among the four sites on ordination axis 1 (see figure 3). Samples from field site 3 consistently received the lowest ordination axis 1 scores, sites 1 and 4 received similar (and mid-range) ordination axis 1 scores, and site 2 received the highest scores. This result was regardless of date and treatment, demonstrating that differences among the various field sites was the most important factor affecting ordination results. This separation may be the result of differences in moisture availability among the sites.

We used the "overlay main matrix" function in PC-Ord to examine relationships between sites and species abundance. Table 1 contains lists of species associated with each of the four sites. Site 3, the site receiving the lowest Axis 1 scores, was the only site with samples having *Euphorbia corollata*, *Lepidium campestre*, *Hedeoma hispida*, *Lactuca canadensis*, and *Holosteum umbellatum* present. In Illinois prairies, *Euphorbia corollata* is abundant on drier sites, such as hill prairies (Corbett 1999). None of these species had high abundance before treatment.

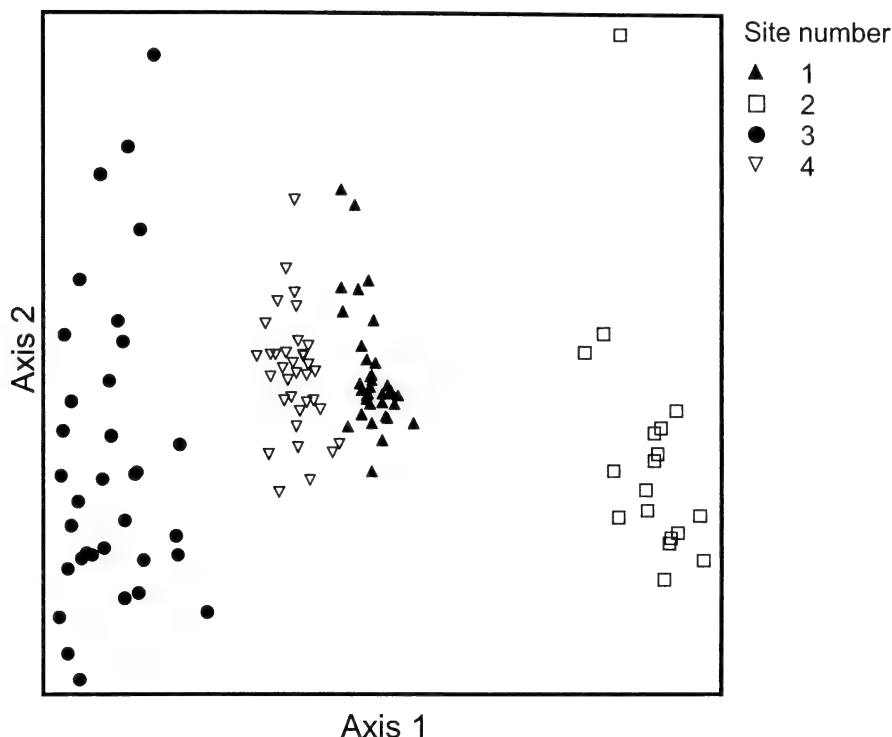


FIGURE 3: Detrended correspondence ordination of all treatments for all sites at all dates. Ordination axis 1 separates sites on the basis of moisture availability. Separation on axis 2 is unclear and may not be meaningful.

Site 2 was the only site to have *Carex* spp., *Cornus stolonifera*, *Equisetum*, and *Juncus tenuis* present. All of these species are typically thought of as being present on wetter sites. Site 2 also had several species of *Aster* and of *Solidago*, as well as *Acalypha rhomboidea*, which are sometimes found in prairies. Sites 2 and 3 were the most different from one another in terms of species composition. Again, these species were not present in high abundance prior to treatment.

Sites 1 and 4 shared many species (see table 1). Many of these species, such as *Aster ericoides*, are considered to be species present on mesic sites (e.g., Curtis, 1971). Sites 1 and 4 did differ somewhat in terms of species composition; however these differences did not show a clear pattern and may more reflect the differing histories of these sites than any environmental difference between them.

We examined the relationships between individual species and the ordination axes. The species showing high correlation with axis 1 tended to be species having either high abundance in site 3 (*Agropyron repens*, $r = -.714$ and *Lepidium campestre*, $r = -.727$) or site 2 (*Sonchus arvensis* $r = .756$, *Solidago canadensis* r

TABLE 1: Lists of species associated with each of the four sites.

Species-site relationships

Site 1:

Barbarea vulgaris
Chrysanthemum leucanthemum
Dianthus armeria
Lepidium virginicum
Medicago sativa
Mollugo verticillata
Plantago rugelii
Potentilla argentea
Rumex crispus
Trifolium hybridum
Verbascum thapsus

Site 2

Acalypha rhomboidea
Agrimonia parviflora
Agrostis alba
Aster laevis
Aster novae-angliae
Carex spp.
Cirsium arvense
Cornus stolonifera (= *sericea*)
Equisetum arvense
Erigeron philadelphicus
Hypericum spathulatum (= *prolificum*)
Juncus tenuis
Solidago canadensis
Solidago graminifolia
Solidago juncea
Solidago rugellii
Sonchus arvensis
Stachys arvensis

Site 3

Hedeoma hispida
Holosteum umbellatum
Lactuca canadensis
Lepidium campestre
Tragopogon major

Site 4

Arenaria serpyllifolia
Bromus tectorum
Centaurea maculosa
Erigeron (= *Conyza*) *canadensis*
Polygonum arvense
Silene dichotoma
Trifolium pratense
Trifolium repens
Verbascum blattaria

In sites 1+4

Potentilla intermedia
Setaria glauca
Achillea millefolium
Aster ericoides
Cirsium vulgare
Phleum pratense
Lychnis alba
Erigeron strigosus

= .743, or *Daucus carota*, $r = .813$). On this basis, it seems that axis 1 reflects differences in site conditions, and possibly, site history.

Axis 2 of the ordination analysis is less informative and shows less separation. In general, the deep-tilled treatments, which received a single application of a more severe disturbance and then were allowed to revegetate naturally, showed higher axis 2 scores than the other treatments. Typically, also, the highest axis 2 scores were shown by deep-tilled sites early in the study, suggesting that deep-tilled sites became "more like" the other sites as time progressed. There was no clear separation among the other treatments, and no clear separation by sampling date.

Axis 2 generally separated the deep-tilled treatments from the other treatments. The only species showing a strong relationship with axis 2 of the ordination is *Ambrosia artemisiifolia* ($r = .615$), which has higher abundance in deep-tilled treatments than in other treatments.

We also analyzed each site individually to determine if there were any pat-

Site 1 data alone

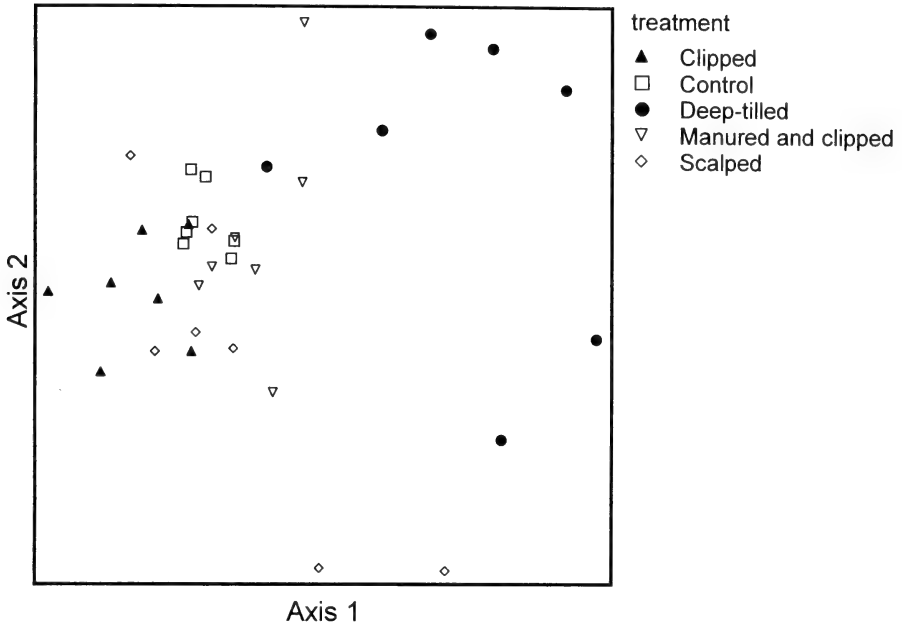


FIGURE 4: Detrended correspondence analysis of Site 1 data alone. The major separation appears to be between the deep-tilled treatment and the other treatments.

terns of treatment or time within each site. For site 1 (see figure 4), the deep-tilled samples separated on axis 1 from other treatments. Deep-tilling apparently had the largest effect on community composition, with other treatments (especially clipping) having very similar axis 1 and 2 scores to the control treatment. There was no clear progression of change over time; this may be partly because of variability inherent in the site and partly because several of the treatments were reapplied during the course of the study.

Site 2, which was a smaller site with fewer treatments applied, showed a clearer pattern of response to treatments (see figure 5). Deep-tilled samples received higher axis 1 scores than either the control or clipped samples. And among the clipped and control treatments, separation was more on the basis of sampling date than on the basis of treatment, with clipped and control plots sampled at the same date receiving similar axis 1 and axis 2 scores.

Site 3 data again showed a separation of the deep-tilled treatment, with no clear pattern among the other treatments. However, the samples for date 4, regardless of treatment, received higher axis 2 scores than other dates (see figure 6).

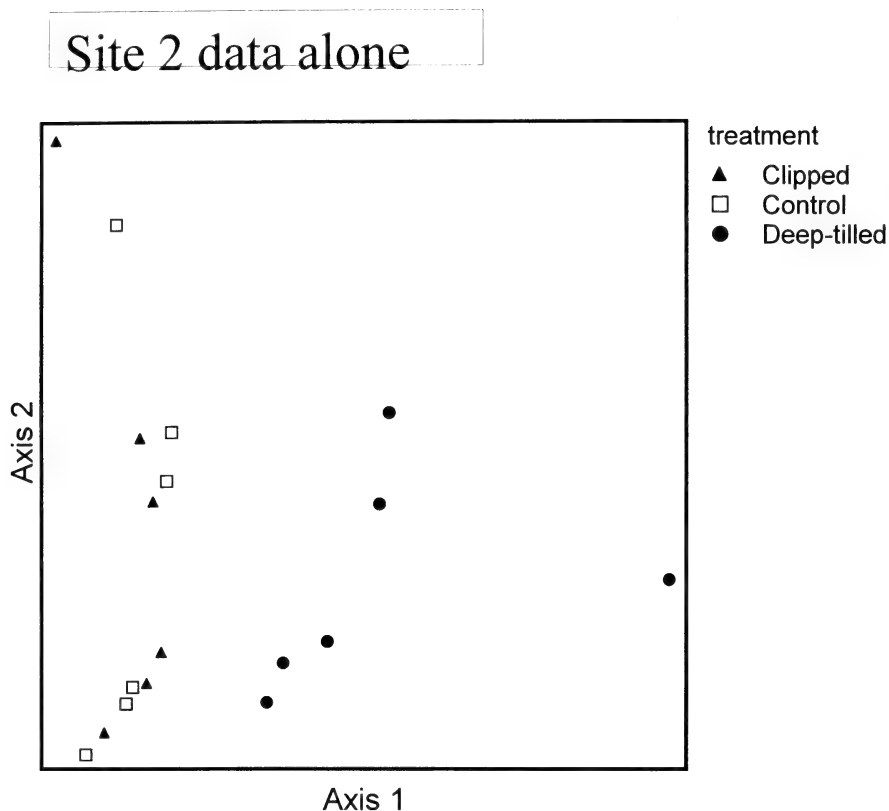


FIGURE 5: Detrended correspondence analysis of Site 2 data alone. The major separation appears to be between the deep-tilled treatment and the other treatments.

The ordination diagram for site 4 is difficult to interpret because of two outlier points (see figure 7). Date 2 for the “scalped” treatment and for the “clipped” treatment are similar in species composition, and are markedly different from the rest of the samples. Examination of the data for date 2 for the clipped and scalped treatments showed that they had very low species diversity: the clipped treatment had only *Cirsium vulgare*, *Erigeron strigosus*, *Lychnis alba*, *Oxalis stricta*, *Plantago lanceolata*, *Potentilla recta*, and *Silene dichotoma* present. The scalped treatment had even lower species diversity, with only *Plantago lanceolata* and *Potentilla recta* present.

When the data are re-analyzed with both outlier samples removed, the deep-tilled treatment for date 2 becomes an outlier, but not so severely as the clipped and scalped treatments were. The main separation on axis 1 is between the mowed and clipped treatments, which received high axis 1 scores, with the other treatments generally intergrading.

For the statistical analysis of species richness, sites differed significantly (p

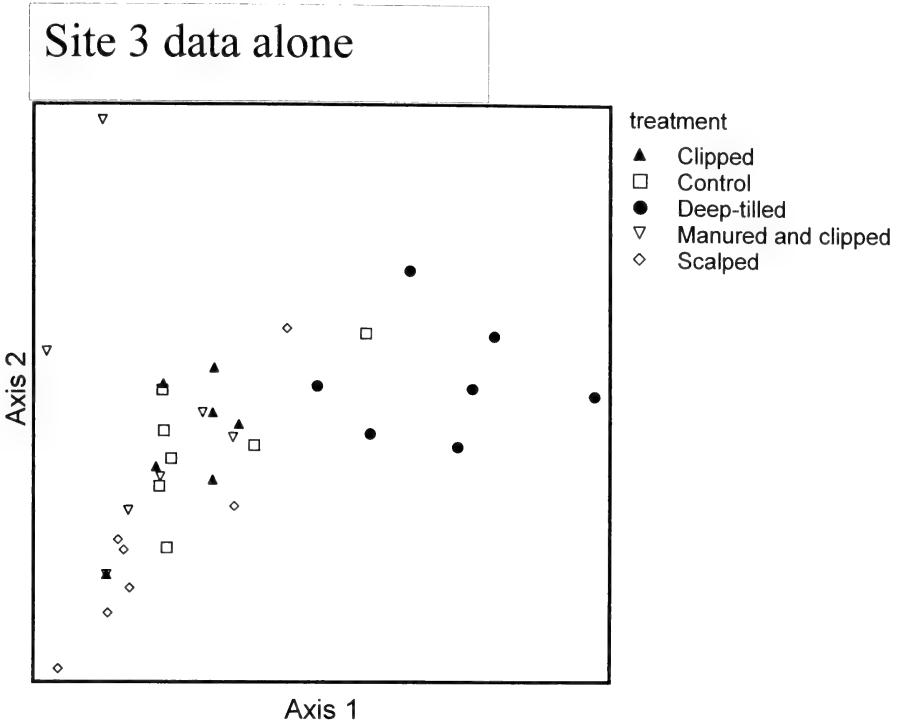


FIGURE 6: Detrended correspondence analysis of site 3 data alone.

<.0001). Site three had a significantly lower species richness than all other sites (mean = 7.71), and site 1 had a significantly greater species richness than all sites (mean = 24.86). Sites 2 and 4 did not differ significantly from each other in species richness.

There were significant differences among treatments in species richness ($p = .0043$). The control treatment had significantly higher species richness (mean = 22.81) than the clipped, manured and clipped, or the scalped treatment. It was not significantly different from the deep-tilled treatment (mean = 17.81), but the deep-tilled treatment was not significantly greater than the clipped, manured and clipped, or scalped treatments.

DISCUSSION

Based on the ordination analyses, the major difference among sites and treatments were environmental differences between the four sites surveyed. Ordination axis 1 separated the four sites, with site three receiving the lowest axis 1 scores, site two receiving the highest axis 1 scores, and sites one and four receiving similar (mid-range) scores. This difference is related to moisture avail-

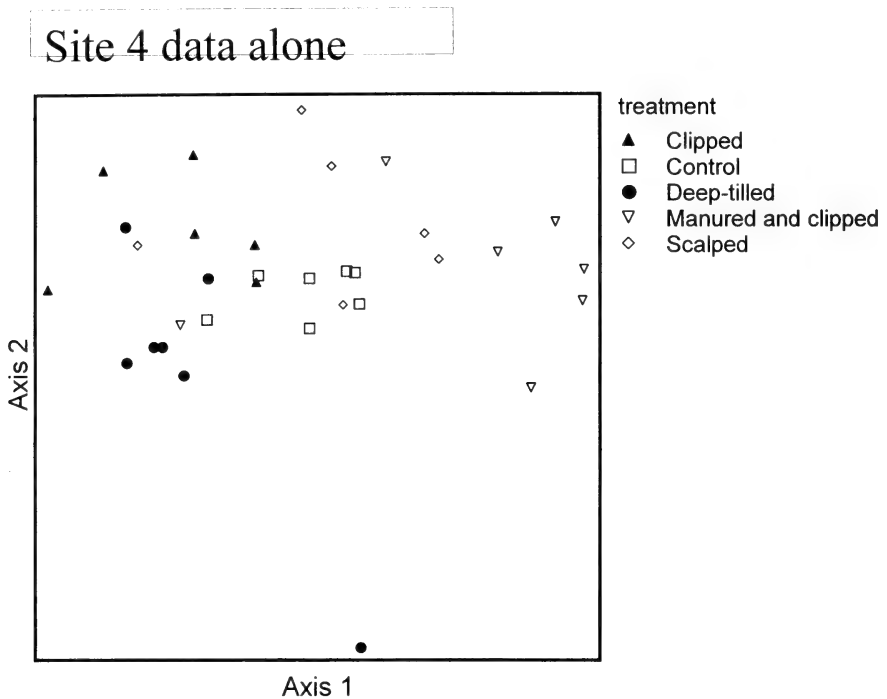


FIGURE 7: Detrended correspondence analysis of site 4 data alone. Outlier points (the clipped and scalped treatment for date 2) were removed.

ability—site three is the driest of the four sites and site two is the wettest. Sites 1 and 2 belonged to similar soil associations but differed in degree of drainage, with site 1 supposedly showing poorer drainage than site 2 (this contradicts the results of the detrended correspondence analysis). Site three, the driest site, had a sandy loam soil that was considered to be “well-drained”. This site also showed the highest percentage slope of all four sites. Site 4 had an altered soil profile resulting from sand and gravel removal, but the alterations were not great, as this site showed similarities in ordination scores to site 1. All four sites received similar precipitation and had similar temperature regimes, so the differences observed were most likely related to topographic position and substrate conditions.

Agropyron repens had high relative frequency in site three samples. In some samples, this species achieved high levels of relative frequency and dominated the samples. This may have affected the species-richness result; site three had the lowest species richness of all sites. This species was present on site 3 before the treatments were applied; it is likely that disturbance of the site allowed further spread of this species.

Among the individual treatments, the deep-tilling treatment had the greatest effect on the species composition, with deep-tilled treatments receiving the highest axis 2 scores. The species having the greatest relationship with this axis was

Ambrosia artemisiifolia, which had highest abundance in deep-tilled sites. This result was somewhat similar to that found by Miller (1994), who established a five-species system on a tilled site to test competitive and indirect effects. He found that *Ambrosia* had the greatest competitive effect on other species, and was relatively insensitive to competition from the other species planted. *Ambrosia* was not abundant in any of the other treatments in this study, including the scalped treatment. Possibly, the deep-tilling treatment (or the plowing, in Miller (1994)) brought buried seeds to the surface and allowed for their rapid establishment and growth. Interestingly, Armesto and Pickett (1985) found that *Ambrosia artemisiifolia* was one of the species that responded positively to a clipping disturbance, and that clipping increased species richness. We did not find either to be the case in the current study.

It is possible that we did not find more differences between treatments because the sites were sampled at different times across the season for 3 years, rather than sampled yearly for a longer span of years. Maycock and Guzikowa (1984) note that the species abundance on their study sites changed over the course of the season, because plants display different phenology.

Earlier studies of Michigan old-fields demonstrated that moderately fertile, cleared land developed high population density of *Poa pratensis* or *Phleum pratense*, whereas *Agrostis alba* and *Poa compressa* invaded areas with lower fertility and thin upland soils (Wheeler 1950). Benninghoff et al. (1961) studied communities that redeveloped on silty soil and gravelly sand or till following agricultural abandonment. They found that *Agrostis alba*, *Phleum pratense*, *Trifolium pratense*, and *Trifolium repens* were abundant on these sites. However, none of these species were major species in the current study.

In old-field succession studies in the literature, various species of *Solidago* (esp. the *Solidago canadensis*—*altissima* complex) are frequently listed as species having high abundance or responding positively to the disturbances that give rise to old fields. Maycock and Guzikowa (1984) describe it as forming large clones and being able to remain competitive for long periods of time. *Solidago* was also the most speciose genus found in their study. Removal or reduction of *Solidago* through herbivory or clipping increased diversity in fields where it had dominated (Armesto and Pickett 1985, Carson and Root 2000). In our study, *Solidago* species only reached high abundance in site 2. This may in part be a result of different site histories. Armesto and Pickett (1985) describe *Solidago canadensis* as colonizing old fields by seed early in succession, then forming large clones that are resistant to invasion by other species.

Agropyron repens had highest relative frequency in Site 3 samples. In fact, this species was the species with highest relative frequency in a number of samples from this site. Maycock and Guzikowa (1984) list *Agropyron repens* as a species present on drier sites in their study, which is also apparent in the current study. *Agropyron* is also thought to be allelopathic (Werner 1975), which could in part explain its high abundance on site three. It is not clear whether environmental differences at the other sites prevented it from growing there, or if it merely had not spread to the other sites yet.

Another concern is woody invasion. Tree seedlings were present in the Michigan sites, specifically *Acer negundo*, *Quercus alba*, and *Ulmus americana*,

but they showed closer relationship with site (*Acer* seedlings were present in site 3, *Quercus* in site 1, and *Ulmus* in site 2), rather than with treatment. This pattern probably reflects what tree species were closest to each site.

When each site was examined independently, similar patterns of reactions to treatments were revealed. In all sites, deep-tilling had the greatest effect on species composition, with deep-tilled treatments receiving higher ordination axis scores than the other treatments. Deep-tilled sites also had significantly lower species richness. Other treatments seemed to have similar effects on species composition and richness.

The greatest differences we observed in this study were related to environmental differences among the different sites. These differences resulted from substrate and location differences. Additionally, site history may affect the composition of the different sites. Individual treatments had less of an effect on species composition. It seems that old field succession is largely affected by individual site conditions, with less of an effect from the type of disturbance that most recently took place.

ACKNOWLEDGMENTS

We acknowledge the much-appreciated guidance of the late William S. Benninghoff, who was the dissertation advisor of the second author.

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REVIEW

Boewe, Charles, editor. 2003. *Profiles of Rafinesque*. The University of Tennessee Press, Knoxville. ISBN 1-57233-225-5. Hardcover, 456 pages; \$45; www.utpress.org; MC & Visa.

Of the many naturalists active in eastern North America since colonial times, surely none has received as much historical and biographic attention as Constantine Samuel Rafinesque (1783-1840). The man is legendary not only for his prolific descriptive work, naming genera and species by the thousands, but for his irascible personality and iconoclastic views. Volumes have been written about him in the 164 years since his death; is there anything more to be said? Is there really a place for yet another account of Rafinesque's life and work?

The present volume has taken a unique approach. At first glance, it appears to be the published proceedings of some symposium. Structurally, it comprises 20 chapters, divided into five major categories: "The Man," "The Naturalist," "The Philologist," "The Writer," and "The Legend." Eight of the chapters were written by the book's editor, Charles Boewe. The remainder were the work of 13 individual authors, including such well-known naturalists as Elmer D. Merrill, Francis W. Pennell, Leon Croizat, and John James Audubon. Yes, Audubon, who died in 1851. And therein lies the uniqueness of this work. It is not a symposium volume; instead, the editor has assembled his story from pre-existing essays, offering just enough freshly crafted work to serve as mortar.

The acknowledgments on pg. xiii credit the respective copyright holders for permission to reprint the material that forms 16 of the chapters. (No mention appears here of the source of Audubon's essay, presumably because it has passed into public domain.) Incredibly, however, we are given *no* bibliographic citation of the places of publication of these reprinted works, nor even the year the copyright was claimed. For example, we are only told that Chapter IX appeared in *Archivio Botanico*, while Chapter XIV is merely credited to "Kluwer Academic Publishers." While this may satisfy the requirements of copyright law, it is terribly unsatisfactory to the scholar or even the casual reader. I can conceive of no logical reason why an editor would consciously make so egregious an omission.

Bibliographic imprecision aside, this is an extremely satisfying work to read. The editor has selected exactly the right essays, and furthermore, incorporated them in a most satisfying fashion. For example, Chapter I is Pennell's "The Life and Works of Rafinesque," the definitive biographical sketch of the eccentric naturalist. However, Rafinesque scholarship has grown since its original publication in 1942; many "facts" as stated by Pennell are now known to be incorrect. Rather than allow such inexactitudes to stand unchallenged, editor Boewe has inserted his own clearly marked footnotes among the original ones, correcting and clarifying as necessary. We thus have the benefit of Pennell's historic viewpoint, annotated in light of current knowledge.

The sequence and arrangement of the various entries is logical and efficient. For example, Croizat's "concrete case" that Rafinesque was plagued by mental illness is followed immediately by Merrill's rebuttal of the diagnosis. We thus enjoy benefits of juxtaposition not available to Croizat and Merrill's original audiences. The overall impression is that the editor has shown great skill and discretion in his choice and arrangement of previously published essays to include, forging a coherent document from these disparate sources. There is some repetitiveness inherent to the book's compilatory structure, as the various authors independently address the same points in many cases. But it is not a serious distraction by any means.

Another positive aspect of this book is its breadth. Rafinesque was a man of wide interests. Though we botanists often regard him as one of us, he was likewise very active in zoology (especially ichthyology and malacology) and philology. All of these are covered in a balanced fashion by this volume. In particular, the chapters dealing with his linguistic works opened for me a facet of the man's career that was completely unfamiliar to me.

Perhaps the most satisfying aspect of the book was the editor's refusal to accept "received wisdom" uncritically. A colorful figure like Rafinesque generates many myths and legends of varying veracity. Boewe has gone to great lengths to investigate all of these. In this volume, we are provided with documentation that disproves the widely believed story that Rafinesque died penniless and alone in a filthy garret. We learn that Rafinesque is *not* buried in Rafinesque's Tomb at Transylvania University, and that some of his portraits don't portray him. We are treated to his autopsy report and a major amplification of his family tree. The book is well worth reading if only to have the record set straight regarding so many supposed "facts" of his life.

In summary, this book superbly summarizes our current understanding of this controversial figure and his contributions to science and language. It is comprehensive in coverage, temperate in tone, and judicious in its pronouncements. It is a highly enjoyable read, yet scholarly and erudite in approach. Despite all that has been written about Rafinesque, Boewe's book deserves a spot on the shelf as "reference of first resort" on this fascinating naturalist.

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DOES STEEPLEBUSH (*SPIRAEA TOMENTOSA*) FACILITATE POLLINATION OF VIRGINIA MEADOW BEAUTY (*RHEXIA VIRGINICA*)?

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ABSTRACT

Facilitation through pollinators is a rarely investigated topic. *Rhexia virginica* (Melastomataceae) is a bumblebee-pollinated, Atlantic coastal plain disjunct herb that is rare in Wisconsin. *Spiraea tomentosa* (Rosaceae), a native shrub often growing in the same location, blooms at approximately the same time of year, and bumblebees often fly between these species. We tested the hypothesis that the presence of *Spiraea* increases pollinator visits to *Rhexia*. We observed sites that varied in their densities of *Spiraea* inflorescences and *Rhexia* flowers and recorded bumblebee visits to *Rhexia* across these sites. Visits to *Rhexia* increase significantly in the presence of flowering *Spiraea*. However, bumblebee visits to *Rhexia* decline with increasing densities of *Spiraea* inflorescences, suggesting that facilitation is replaced then by competition for pollinators. Facilitation might occur because *Rhexia* offers only pollen as a reward whereas *Spiraea* offers nectar, and these are complementary resources for bees.

INTRODUCTION

The Virginia meadow beauty, *Rhexia virginica* L., belongs to the primarily tropical family Melastomataceae. While its primary range is the Atlantic coastal plain, disjunct populations are also found in the Great Lakes region. Along with other coastal plain disjuncts, *Rhexia* inhabits sites in central and northern Wisconsin where soils are very sandy and moist. Disjunct populations in the Great Lakes arrived in that region either by long distance dispersal or by a series of shorter dispersal events along the shorelines of glacial lakes and drainages present as the glaciers receded (Reznicek 1994).

Rhexia is rare and listed as a species of "special concern" in Wisconsin. Disjunct populations are especially vulnerable to population loss because they lack a constant influx of seeds to rescue extirpated populations, and because extant populations are often sparse (Reznicek 1994). Little research has been done on *Rhexia* in the midwest. *Rhexia*'s habitat in Wisconsin consists of wet, sandy soil, typically along lakeshores or in sedge meadows. It is a perennial herb that stands approximately 30 cm high and is pollinated almost exclusively by bumblebees. Recruitment from seed is important for *Rhexia* populations because populations are often small, and the probability of immigration of seed from other popula-

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tions is infinitesimal. Baskin and Baskin (1998) examined germination properties of *Rhexia mariana*. To germinate, seeds need at least 56 days of cold, followed by light and temperatures of 35/20°C. *Rhexia virginica* might well require similar conditions. As *Rhexia* habitats are prone to flooding, all plants can be killed in some years. Seeds can remain dormant for many years (Keddy and Reznicek 1982). This seed bank ensures populations can persist following floods.

Rhexia lacks nectar and only offers pollen as a reward to pollinators. The anthers have pores and are "buzz pollinated." Anthers on newly opened flowers are long and bright yellow. Individual flowers are only fertile for one day. After that, the anthers turn red and the petals fall off. New flowers are produced throughout late summer.

In central Wisconsin, steplebush, *Spiraea tomentosa* L. var. *rosea* (Raf.) Fernald, often grows alongside *Rhexia*, and they flower at the same time. Bumblebees are often observed flying between *Rhexia* and *Spiraea*. Because *Spiraea* is rich in nectar, it might increase the chances of *Rhexia* being visited by bumblebees, as it offers a complementary food source. If *Spiraea* facilitates *Rhexia* pollination, conservation efforts might be directed toward maintaining or restoring mixed populations.

MATERIALS AND METHODS

We surveyed pollinator visitation rates at two sites in Marquette County, Wisconsin, chosen for their relatively large *Rhexia* populations. Both populations were located along privately owned lakeshores. Site A was on a small lake (T16N, R10E, Sec 7 SW $\frac{1}{4}$) and site B was on a pond several km away (T17N, R10E, Sec 30 SW $\frac{1}{4}$).

To assess local effects of flowers on pollinator visitation, we established circular plots of 10m². We selected plots of this size because they were both large enough to have a high probability of a bee entering the area and small enough to allow tracking all the bees in a plot. The plots were centered around an individual *Rhexia* plant. There were 35 plots, 19 at site A and 16 at site B. The plots were established in June, before there were any flowers on either *Rhexia* or *Spiraea*. We collected data through July, August, and into September, visiting site A nine times and site B ten times. During each visit, we counted the number of fertile *Rhexia* flowers and the number of fertile *Spiraea* inflorescences within each 10 m² plot. We then recorded the number of bumblebee visits to *Rhexia* flowers and *Spiraea* inflorescences within the plot during a 5-minute period. Plots were observed between 7 am–1 pm and 5 pm–8 pm. All plots were surveyed during each visit, and as each site was visited repeatedly, each plot was observed for a total of 45–50 minutes. The visits on 16 days resulted in 47 hours of observation. Although we also recorded weather conditions, these did not appear to affect bumblebee foraging behavior. Larson and Barrett (1999) also observed that visitors to *Rhexia* are insensitive to weather. As bumblebees are able to forage under harsh conditions, it is not surprising to find little variation in activity in July and August in Wisconsin (Heinrich 1979). It was not necessary to modify the densities of the two species as the density of fertile flowers changed from day to day. The fluctuations in flower densities also acted to make the results from the same plot on different days largely independent from one another.

We applied two tests to examine how *Spiraea* flowering affected patterns of bumblebee visitation to *Rhexia*. First, we examined how site and the presence or absence of *Spiraea* affected *Rhexia* visitation rates, using a two-way ANOVA. We then reduced the data to include only plots that had at least one fertile *Rhexia* flower and one *Spiraea* inflorescence and examined how *Spiraea* density affected *Rhexia* visits as a covariate in a one-way analysis of covariance, with site as the factor and *Spiraea* density as the covariate.

Because densities of *Rhexia* and *Spiraea* are positively correlated, we needed further tests to confirm that any correlation between *Spiraea* density and visits per *Rhexia* flower was not actually due

TABLE 1. Two-way ANOVA showing the affects of site and *Spiraea* inflorescence presence on visitation rates of bumblebees on *Rhexia* flowers (n=267).

Variable	df	SS	F	P
<i>Spiraea</i> presence/absence	1	0.80	5.98	0.015
Site	1	0.00	0.00	0.97
<i>Spiraea</i> presence X site	1	0.14	1.04	0.21
Error	263	34.99		

to a correlation between *Rhexia* density and visits/flower. Using the method of standardized partial regression coefficients, we calculated path coefficients between: *Rhexia* density and visits per *Rhexia* flower, *Spiraea* density and visits/flower, and *Rhexia* density and *Spiraea* density.

RESULTS

Across both sites, there were no difference in bumblebee visits to *Rhexia*, but there was a significant increase in visits to *Rhexia* in plots when at least one *Spiraea* inflorescence present (Table 1; Fig. 1). At site A, the average visits per

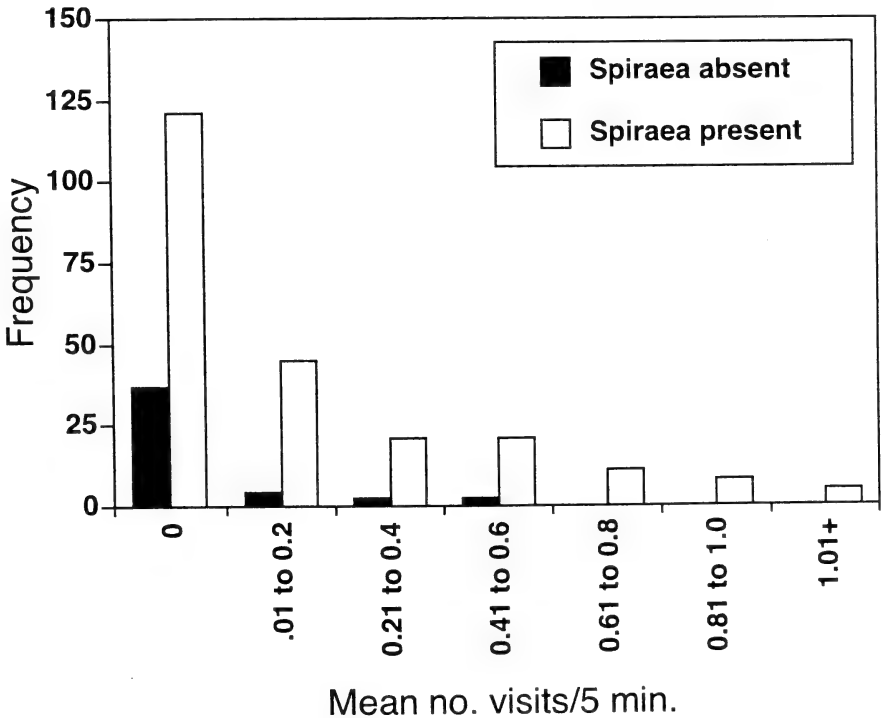


FIGURE 1. Number of bumblebee visits and visits per 5-minute observation interval to *Rhexia* flowers when *Spiraea* is absent (dark bars) and present (white bars).

TABLE 2. One-way ANCOVA showing the effects of site and *Spiraea* inflorescence density on visitation rates of bumblebees to *Rhexia* flowers at each of two sites and plots ($n = 14$; total $r^2 = 0.41$).

Variable	df	SS	F	P
Site	1	0.07	1.50	0.25
<i>Spiraea</i> inflorescence density	1	0.30	6.85	0.024
Error	11	0.49		

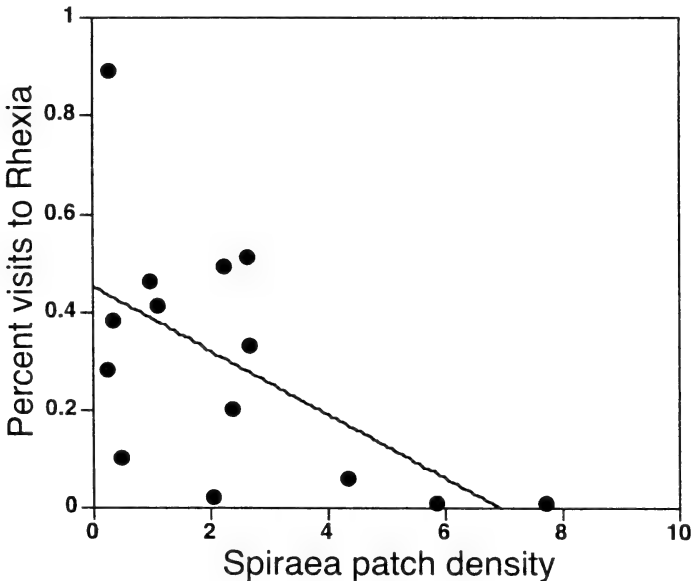


FIGURE 2. The relationship between the average bumblebee visits per *Rhexia* flower and *Spiraea* inflorescence density per square meter when *Spiraea* was present ($df = 1$; $r = -0.58$; $P = 0.024$).

Rhexia flower increased over twofold per 5 minutes and at site B, it increased over fourfold. Once *Spiraea* is present, however, bumblebee visits to *Rhexia* appear to decline with increases in *Spiraea* inflorescence density ($r = -0.58$; Table 2, Fig. 2). Again, there were no differences in visits per *Rhexia* flower due to site.

Using path coefficients, the direct effect of *Spiraea* density on visits per *Rhexia* flower was -0.577 (Fig. 3). The indirect effect is the product of all coefficients in the pathway. The indirect effect of *Spiraea* on visits/flower was -0.013 . These results show that the stronger and only statistically significant influence on visitation rate to *Rhexia* flowers is *Spiraea* density.

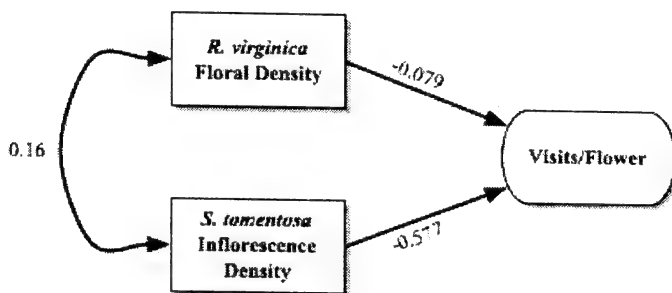


FIGURE 3. Diagram showing the factors that influence bumblebee visits to *Rhexia* and the possible paths and coefficients of influence. (Direct effect of *Spiraea* = -0.577; Indirect effect of *Spiraea* = -0.013).

DISCUSSION

In central Wisconsin, *Rhexia* has higher visitation rates per flower when *Spiraea* inflorescences are present. Yet visitation rates to *Rhexia* when *Spiraea* is present decline with increasing *Spiraea* inflorescence density. Thus, small densities of *Spiraea* inflorescences appear to facilitate *Rhexia* visitation, whereas *Spiraea* appears to compete with *Rhexia* for pollinator visits when *Spiraea* inflorescences become dense. This pattern may arise because of resource complementarity. *Rhexia* only offers pollen as a pollinator reward; while bumblebees need pollen as a protein source, they also need nectar as an energy source (Heinrich 1979). *Spiraea* offers both pollen and nectar as pollinator rewards. Therefore, bumblebees might be attracted to *Rhexia* by its copious pollen but remain in the area because *Spiraea* provides them with plentiful nectar. Rathcke (1983) argues resource complementation could result in higher pollinator visitation rates as these resource patches are highly attractive to pollinators. Resource complementarity has been experimentally demonstrated with frugivorous birds. Whelan et al. (1998) found that birds reared on complementary fruit resources had higher fitness than those reared on a single fruit resource.

The potential for resource complementarity has important implications for species coexistence. Callaway (1995) observed that co-flowering species experience facilitation when one plant species is more attractive to pollinators than a neighboring species. This is consistent with what we observed with *Rhexia* and *Spiraea*. The presence of *Spiraea* appears to provide an advantage to *Rhexia* by attracting bumblebees to the area. While bumblebees are there, they find a complementary food source (pollen) in *Rhexia*. However, visits to *Rhexia* decreased in plots with the most *Spiraea* inflorescences, suggesting the bees are “majoring” in collecting nectar (Heinrich 1979). The increased number of *Spiraea* inflorescences might also visually overwhelm the *Rhexia* display, distracting bees from the *Rhexia* flowers.

Spiraea and *Rhexia* often co-occur in the same habitat types, and their ranges overlap (Keddy and Reznicek 1982; Larson and Barrett 1999). Because *Rhexia* is consistently found near *Spiraea*, it might be more persistent when *Spiraea* is

present. If *Spiraea* can increase pollinator visits to *Rhexia*, it might also increase seed set. This hypothesis should be tested by comparing seed set in *Rhexia* populations with and without *Spiraea* present.

These data did not indicate what densities of *Rhexia* and *Spiraea* might be optimal for enhancing bee visitation or seed set in *Rhexia*. We also do not know whether the ratio of *Spiraea* to *Rhexia* or the absolute density of *Spiraea* affects bumblebee visitation the most. Further studies might clarify this issue as well by manipulating *Spiraea* densities to see what *Spiraea* inflorescence density or ratio to *Rhexia* flower density optimizes bee visits and/or seed set.

ACKNOWLEDGMENTS

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BOOK REVIEW

“Great Lake’s Wildflower Guides”

Tekiela, S. 2000. *Wildflowers of Michigan Field Guide*. Adventure Publ., Inc., Cambridge, MN, 412 pp. ISBN 1-885061-91-9. Ibid. 1999. *Wildflowers of Minnesota Field Guide*. 410 pp. ISBN 1-885061-63-3. Ibid. *Wildflowers of Wisconsin Field Guide*. 410 pp. ISBN 1-885061-77-3. Ibid. 2001. *Wildflowers of Ohio Field Guide*. 410 pp. ISBN 1-885061-37-4. All books are \$16.95.

Some months ago a friend came to me and asked if I had seen the new wildflower book for Michigan. I had not. Once I had seen it, I decided to search one out for myself. It was then that I learned that the same author, Stan Tekiela had written four books on wildflowers for four states bordering the Great Lakes. I will use the one for Michigan as a starting point for evaluating the four books.

According to the back cover the author “is a naturalist and wildlife photographer who writes a syndicated nature column and appears on a number of nature radio shows.” Not only has he written the four books on wildflowers but guides on birds of the same states. Each book is $4\frac{1}{2}'' \times 6''$ and is a nice size to go in a fanny pack or the glove compartment of an automobile. The cover is plasticized paper with a fine color image on the front (Wood Lily—Michigan; Showy Lady’s Slipper—Minnesota; Large-flowered Trillium—Wisconsin; and Wild Geranium—Ohio) that should repel some moisture that one will certainly encounter if the book is taken into the field.

The Table of Contents lists an Introduction (though not titled such on the page listed); Sample Page; a listing of The Wildflowers arranged along a color code of blue, brown, green, orange, pink, purple, red, white, and yellow; a Checklist/Index where the user can check off in boxes species encountered and the page shown in the book; a four page Glossary of approximately 65 terms; a discussion about the author being a naturalist and award winning author, etc. (information about his background or training in biology that makes him a naturalist—including a picture—is lacking). Two hundred very fine photo images are printed, each covering one page with the facing page giving the common name, scientific name (without author), family, height, flower (a general description), leaf (morphology), fruit, bloom (season of the year), cycle/origin (annual, perennial, biennial, native, and non-native), habitat, range (within the state), and Stan’s notes. This last category gives interesting natural history or medicinal information about each species. At the bottom of each page are colored icons with the various morphological categories mentioned above (e.g. flower type, leaf type, fruit, etc.). A helpful colored “thumb tab” is placed in the upper right hand corner to facilitate rapid location of the flower color sections of the guide.

A survey of the four books gives this reviewer the impression that the *Wildflowers of Minnesota Field Guide* was produced first and that the other four are really extensions of this first one. A comparison of Minnesota and Michigan guides shows 175 images the same with the exact same written information. Ap-

proximately 25 were different, but most of those listed as distinctive in the guide for Minnesota are also known to be in the Michigan flora. The same information was found when the listing for the Wisconsin guide was compared with the one for Michigan. The Michigan state wildflower, the Dwarf Lake Iris was missing from the Michigan guide, as was the American Lotus. Ragweed (really Giant Ragweed), Skunk Cabbage, Wild Mint, and Trailing Arbutus were illustrated in the Michigan guide but lacking in the Minnesota and Wisconsin books. No mention was given as to what criteria were used in choosing the species for each book. I recognize preparing books like this for the general public is hard, but there should be some reason for choosing particular species.

To undertake the above cross-checking of the species found within and between each book meant that I had to handle each page of each book twice. This resulted in all four books falling apart to varying degrees. The text was printed in sixteen-page signatures and then stitched. This stitching stayed intact but the glue holding the cover to the back of the book is poor and all covers have broken from the stitched book. This is the fault of the binder and will be a real turn off for a person using all four books. The books will not withstand heavy use and will have to be replaced. I therefore cannot recommend the purchase of any of the four books until this major fault has been rectified. If the user can overlook this fault the wildflower lover may find the books helpful.

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The four numbers of volume 42 for 2003 were mailed on the following dates:

42(1)	28 May 2003
42(2)	26 September 2003
42(3)	31 January 2004
42(4)	3 April 2004



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On the cover: Swamp rose-mallow (*Hibiscus moscheutos* L.) along the marshes of the Oxbow Lagoon near the mouth of the Kalamazoo River near Saugatuck, Allegan County, Michigan. Ranging from Massachusetts and New York to Ohio, southern Wisconsin, and Missouri, south to the Gulf of Mexico, this *Hibiscus* is a species of special concern in Michigan, where it occurs only in a few counties in the southwestern and southeastern parts of the state. This specimen occurs on the private parcel known as the Denison tract and in the wetlands along the edge of the City of Saugatuck's Tallmadge Woods preserve beside the Kalamazoo River. It is one of several rare species which conservation groups want to protect by working together with state and local governments to acquire the 413-acre Denison tract for addition to nearby park lands of the City of Saugatuck and State of Michigan. An adult Bald Eagle and a Black Tern (another species of special concern in Michigan) were seen over this marsh on the date of the photograph. Another species of special concern, trailing wild bean (*Strophostyles helvula* (L.) Elliott), was also documented nearby along the edge of the Oxbow Lagoon on this date.

Photograph by Doug Powless, Land Conservancy of West Michigan, 23 August 2002

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RARE AND UNUSUAL FUNGI (BASIDIOMYCOTA) OF THE HURON MOUNTAINS, MARQUETTE COUNTY, MICHIGAN

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ABSTRACT

Twenty-three species of fungi (Basidiomycota) which are uncommon or rarely encountered in the Lake States are reported from the forests of the Huron Mountains, Marquette Co., Michigan. Brief descriptions are given and references provided regarding the occurrence of these species in north-eastern North America and Michigan. The works of Dr. Alexander H. Smith are especially considered due to his extensive studies of mushrooms in the Lake States.

INTRODUCTION

The forests of the Huron Mountains in Marquette Co., Michigan consist of approximately 20,000 acres (8,097 ha) of mixed conifer-hardwood owned by the Huron Mountain Club, the core of which is approximately 8,000 acres (3,239 ha) of old growth forest designated as the Reserve Area. Sugar maple (*Acer saccharum* Marsh.), white pine (*Pinus strobus* L.), and eastern hemlock (*Tsuga canadensis* (L.) Carr.) compose the dominant forest type throughout, inter-mixed with Canada balsam (*Abies balsamea* (L.) Mill.), paper birch (*Betula papyrifera* Marsh.), yellow birch (*Betula alleghaniensis* Britt.), red oak (*Quercus rubra* L.), quaking aspen (*Populus tremuloides* Michx.), big-tooth aspen (*Populus grandidentata* Michx.), basswood (*Tilia americana* L.), red maple (*Acer rubrum* L.), striped maple (*Acer pennsylvanicum* L.), red pine (*Pinus resinosa* Ait.), jack pine (*Pinus banksiana* Lamb.), white spruce (*Picea glauca* Moench), black spruce (*Picea mariana* (Mill.) B.S.P.), and several lesser species (Simpson et al. 1990). These forests lie along the south shore of Lake Superior (Fig. 1); elevations range from approximately 600 ft (183 m) at lake level to several peaks of 1,400–1,500 ft (427–472 m) one to two miles inland.

For the past eight years the author has conducted surveys of mushrooms in the Huron Mountains, concentrating mainly on mycorrhizal species fruiting in old growth stands of red pine (*Pinus resinosa* Ait.) (see *Reports to the Huron Mountain Wildlife Foundation*, Richter, 1996–2003, available through www.hmwf.org). In the course of these surveys, and in adjacent habitats, mushrooms have been found that are not commonly collected in the Lake States. This is probably due to the relatively unbroken and extensive tract of old growth forest of the Huron Mountain Club lands.

There is a history of collecting and reporting of rare and unusual fungi in the Huron Mountains (e.g. Ammirati & Smith 1972, Weber 1972, Ginns 1994). At

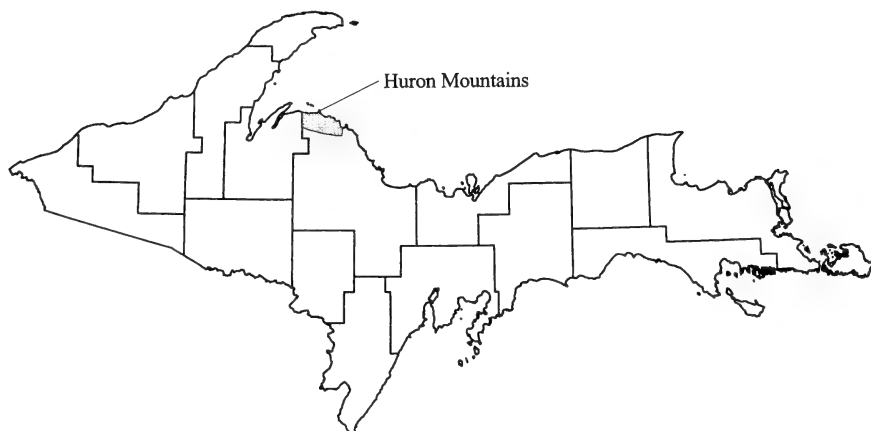


FIGURE 1. Location of the Huron Mountains in Marquette Co. in the Upper Peninsula of Michigan.

least two species of mushrooms are named for the Huron Mountains because they were either first collected there or found only in old growth habitat typical of the Huron Mountains. One of these is the mycorrhizal and hemlock-associated *Boletus huronensis* Smith & Thiers (Smith & Thiers 1971), and another is the saprotrophic and hemlock-associated, *Laetiporus huroniensis* Burdsall & Banik (Burdsall & Banik 2001).

This work reports 23 species of mushrooms collected in the forests of the Huron Mountains that are otherwise rarely encountered in the Lake States. The works of Dr. Alexander H. Smith are especially referenced due to his extensive studies of mushrooms in the Lake States for his entire mycological career. References cited may differ regarding the frequency of occurrence of these species; however a criterion used in including a species is the author's experience of over twenty years of collecting in the western Lake States. Some anecdotal information based on the author's experience is also provided.

MATERIALS AND METHODS

Habitats within the Huron Mountain forests were visited in August and September from 1995 to 2003. Both mycorrhizal and saprotrophic fruiting bodies were collected; all are Basidiomycota. Photographs were taken in the field and representative specimens were returned to the laboratory for identification. Fruiting body characters were recorded in the fresh condition, as were spore color and spore size when necessary for identification; abbreviated descriptions are given here; height refers to entire length of fruiting body; pileus size refers to diameter. Specimens were assigned collection numbers, dried, and maintained in the author's collection (designated here as *hmc*) or deposited in the Herbarium of the University of Michigan (MICH). It is the author's intention eventually to deposit all collections in MICH. Subsequent observations of fruit bodies that are cited but not collected are given numerical occurrence codes: occasional (OC) = 1–3 fruiting bodies, frequent (FR) = 4–10 fruiting bodies, abundant (AB) >10 fruiting bodies. For location information "Site" refers to one of seven red pine dominated sites which were regularly surveyed for mycorrhizal species (Richter 1996–2003). To save space, locations of these sites are given below and are listed by Site and number in the species descriptions section; other collection locations are listed separately.

Lowland sites

- Site #1) North of Cranberry Bog; NE $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec 27
Site #2) North of Cranberry Bog; SW $\frac{1}{4}$ of NW $\frac{1}{4}$ of Sec 27
Site #3) North of Second Pine Lake; N $\frac{1}{2}$ of NE $\frac{1}{4}$ of Sec 28
Site #4) North of Pine Lake; NE $\frac{1}{4}$ of SW $\frac{1}{4}$ of Sec 21

Upland sites

- Site #5) North Shore of Rush Lake; S $\frac{1}{2}$ of NE $\frac{1}{4}$ of Sec 19
Site #6) North of Mountain Lake; SW $\frac{1}{4}$ of NE $\frac{1}{4}$ of Sec 30
Site #8) Northeast of Ives Lake; SW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Sec 34

Classification to family follows *Ainsworth and Bisby's Dictionary of the Fungi* (Hawksworth et al. 1995). Fungi are listed in alphabetical order.

SPECIES DESCRIPTIONS***Albatrellus caeruleoporus* (Pk.) Pouzar** (Scutigeraceae)

Synonym *Polyporus caeruleoporus* Pk.

22 Sep 1996, T51N, R28W, Sec 15; along Salmon Trout River near Burnt Dam, mixed conifers and hardwoods; single fruiting body; *hmc-96-030*.

Fruiting body fleshy, bright blue overall; height 6.5 cm; pileus 3.2 cm; angular pores descending central to off-center stalk; on ground; cited as mycorrhizal (Gilbertson & Ryvarden 1986); the genus is not well characterized ecologically or taxonomically (Ginns 1994); called a "pseudobolete" by Bessette et al. (1999); hyphal type indicates relationship with Agaricales or Hydnaceae (Gilbertson & Ryvarden, 1986); cited as infrequent by Bessette et al. (1997), and rare by Smith et al. (1981).

***Albatrellus ovinus* (Fr.) Kotl. & Pouzar** (Scutigeraceae)

Synonyms *Boletus ovinus* Schaeff., *Polyporus ovinus* Schaeff ex Fr.

21 Sep 2001, Site 3; four fruiting bodies; *hmc-01-018*.

Fruiting body fleshy, white to pinkish-buff overall; height 5.8–14.0 cm; pileus 6.0–11.4 cm; angular pores descending central stalk; on ground; this species is considered mycorrhizal, occurring throughout the circumboreal conifer zone (Gilbertson & Ryvarden 1986); (see above species for information on genus); referred to as uncommon in Michigan, with only four collections in herbaria, all from the Upper Peninsula (Ginns 1994); known as the "sheep polypore," and cited as infrequent by Bessette et al. (1995).

***Amanita ceciliae* (Berk. & Br.) Bas (Amanitaceae)**

2 Aug 1995, T52N, R28W, Sec 32, Fisher Creek Trail, mixed conifers and hardwoods, single fruiting body, *hmc-95-001*; 29 Aug 1996, Site 7, occasional; 20 Sep 1996, Site 1, occasional; 18 Sep 1997, Site 3, occasional.

Fruit body fleshy; height 10.8–14.2 cm; pileus 5.8–9.2 cm, tannish-brown; gills white; volval patches on pileus and stem base gray; on ground; this species is mycorrhizal; reported from S, E, and NW U.S. but not reported from Michigan (Jenkins 1986, p.74); cited as infrequent by Phillips (1991); in section *Vaginatae*, which lacks a basal bulb; with floccose rather than membranous volva; this species reported as *A. inaurata* in 1996 and 1997 HMWF reports (Richter 1996, 1997), an invalid but often-used name for the species (Jenkins 1986).

***Amanita porphyria* (Alb. & Schw. ex Fr.) Secr. (Amanitaceae)**

20 Sep 1997, Site 1, three fruiting bodies, *hmc-97-02*; 19 Sep 2002, Site 4, occasional.

Fruiting body fleshy; height 9.4–12.6 cm; pileus 5.6–6.2 cm, brownish-gray with gray patches; gills off-white; basal bulb marginate; annulus gray; this species is mycorrhizal; found throughout continental NA; cited as infrequent by Phillips (1991), occasional to infrequent by Bessette et al. (1995); ashy color of volval remnants and annulus is distinctive and separates this from *A. brunnescens* (Jenkins 1986).

***Austroboletus gracilis* var. *gracilis* (Pk.) Wolfe (Boletaceae)**

Synonyms *Boletus gracilis* Pk., *Porphyrellus gracilis* (Pk.) Singer., *Tylopilus gracilis* (Pk.) Henn.

19 Sep 1997, T52N, R28W, Sec 30, N of Mountain Lake, mixed conifers and hardwoods, single fruiting body, *hmc-97-016*.

Fruiting body fleshy; height 9.0 cm; pileus 4.8 cm, chestnut brown; pores white; stipe reddish brown; on ground; this species is mycorrhizal (Both 1993); given the common name “the graceful bolete”, only three species are placed in the genus; *A. gracilis* is divided into three varieties; cited as seldom collected by Bessette et al. (1999); cited as not common by Smith et al. (1981).

***Boletopsis subsquamosa* (Fr.) Kotl. & Pouz. (Boletaceae)**

Synonyms *Polyporus subsquamosus* Fr., *Polyporus leucomelas* Pers., *Polyporus griseus* Pk., *Polyporus earlei* Underw. (Gilbertson & Ryvarden 1986), and *Boletopsis grisea* (Pk.) Bondartsev & Singer.

21 Sep 2001, Site 3, single fruiting body, *hmc-01-019*.

Fruiting body fleshy; height 7.2 cm; pileus 12.4 cm, gray; angular white pores descending thick stalk; on ground; this species is probably mycorrhizal (Gilbertson & Ryvarden 1986) but little is known of its ecology; circumboreal, on ground, among conifers and hardwoods (Gilbertson & Ryvarden 1986); another of the "pseudoboletes" (Bessette et al. 1999); known as *kurotake* in Japan where it is considered an edible species (Lincoff 1981); more commonly found in the Pacific NW (Smith et al. 1981).

***Boletus morrissi* Pk. (Boletaceae)**

28 Aug 1999, T52N, R28W, Sec 30, N of Mountain Lake, hemlock dominant, three fruiting bodies, *hmc-99-021*.

Fruiting body fleshy; height 8.8–12.4 cm; pileus 5.4–9.0 cm, reddish brown; pores red; stipe yellow with red-brown scabers; on ground; this species is mycorrhizal; unique among the red-pored boletes for having reddening rather than bluing flesh when exposed to air (Both 1993); also with a scabrous rather than reticulate stalk; an E and S NA species (Both 1993, Snell and Dick 1970, Bessette et al., 1999); cited by Bessette et al. (1999) as infrequent; cited by Phillips (1991) as rather rare; not treated in *The Boletes of Michigan* by Smith and Thiers (1971).

***Boletus pinophilus* Pilat & Dermek (Boletaceae)**

Synonyms *B. pinicola* (Vitt.) Vent. and *B. edulis* var. *pinicola* Vitt.

27 Aug 1999, Site 4, two fruiting bodies, *hmc-99-012*.

Fruiting body fleshy; height 12.6–15.2 cm; pileus 7.8–9.8 cm light reddish brown; pores buff; stipe light reddish brown; on ground; this species is mycorrhizal; robust and similar to *B. edulis* Bull. but with reddish brown stipe which bruises darker brown; not listed in *The Boletes of Michigan* by Smith and Thiers (1971) or *How to Know the Non-gilled Mushrooms* by Smith et al. 1981, perhaps due to his not wanting to consider all the subspecies, varieties, and forms of *B. edulis*; Both (1993) cites it as rarely reported, although Bessette et al. (1999) report it as fairly common and widely distributed in NA; one of the best of the edible mushrooms (Snell & Dick 1970).

***Boletus projectellus* Murrill (Boletaceae)**

Synonyms *Ceriumyces projectellus* Murr., *Boletellus projectellus* (Murr.) Singer.

31 Aug 1997, Site 1, single fruiting body, *hmc-97-004*; 20 Sep 1997, Site 1, five fruiting bodies, *hmc-97-021* and *-022*; 28 Aug 1998, Site 1, two fruiting bodies, *hmc-98-001*; 26 Aug 1999, Site 1, 15 fruiting bodies, *hmc-99-002*; 26 Aug 2000, Site 1, five fruiting bodies, *hmc-00-002*; 22 Sep 2000, Site 1, three fruiting bodies, *hmc-00-007* (Tissue Isolate DR-412); 23 Aug 2002, Site 3, single fruiting body, *hmc-02-004*; 19 Sep 2002, Site 1, occasional; 19 Sep 2002, Site 3, fre-



FIGURE 2. *Boletus projectellus* Murrill; *hmc-03-017a*; 17 Aug 2003, in lowland forests among jack pines and red pines, with which it is mycorrhizal.

quent; 19 Sep 2002, Site 4, frequent; 17 Aug 2003, Site 2, two fruiting bodies, *hmc-03-017a* (Fig. 2); 17 Aug 2003, Site 6, two fruiting bodies, *hmc-03-017b*.

Fruiting body fleshy; height 10.4–18.6 cm; pileus 5.8–11.2 cm dark red-brown; pores yellow; stipe light reddish brown with deep striations; on ground; this species is mycorrhizal; known best from the south shores of Lake Superior (Smith & Thiers 1971) but is otherwise found in the southeastern US (Bartelli and Smith 1964); a very attractive mushroom whose western North America counterpart is *B. mirabilis* Murr. (Bessette et al. 1999), with which it is sometimes confused; Smith and Thiers (1971) report *B. mirabilis* from Michigan, however Redhead (1989) has examined their collections and determined them to be *B. projectellus*; this species has the distinction of having the largest spores of any bolete, $18\text{--}33 \times 7.5\text{--}12\ \mu\text{m}$ (Bessette et al. 1999); mature spores from these collections measure $24\text{--}31 \times 9\text{--}10\ \mu\text{m}$; Miller (1980) says infrequent, and also found under Virginia pine in Maryland.

***Boletus subluridellus* Smith & Thiers (Boletaceae)**

28 Aug 1999, T52N, R28W, Sec 30, N of Mountain Lake, hemlock dominant, single fruiting body, *hmc-99-022*.

Fruiting body fleshy; height 12.0 cm; pileus 8.6 cm, red; pores red bruising blue; stipe yellow bruising blue; on ground; this species is mycorrhizal; Bessette et al. (1999) says fairly common and Phillips (1991) says frequent, however the author

has rarely collected it; Smith et al. (1981) cite it as a southern Michigan species; incidentally, Both (1993) says the picture in Phillips (1991, p 230) is not this taxon.

***Cortinarius sphaerosporus* Pk.** (Cortinariaceae)

21 Sep 1996, Site 1, occasional; 21 Sep 2001, Site 2, occasional; 21 Sep 2001, Site 3, abundant.

Fruiting body fleshy; height 6.2–12.2 cm; pileus 2.4–5.8 cm, yellow, sticky; gills rusty-brown; stipe white with yellow-brown hairs; on ground; this species is mycorrhizal; cited as occasional by Smith et al. (1979) and uncommon by Phillips (1991); as with the following species, *Cortinarius* with slimy caps and stalks are applied to the subgenus *Myxacium* (Smith et al. 1979, Phillips 1991).

***Cortinarius trivialis* Lange** (Cortinariaceae)

21 Sep 1996; Site 6, occasional.

Fruiting body fleshy; height 5.4–9.8 cm; pileus 2.8–6.0 cm, tan, sticky; gills light rusty-brown; stipe orange-brown with glutinous rings; on ground; this species is mycorrhizal; cited as uncommon by Phillips (1991); Bessette et al. (1997) equate this species with *C. collinitus* Fr., considered common and found at many sites and years at the Huron Mountains surveys (Richter 1996–2003); Miller (1980) and Phillips (1991) separate *C. trivialis* from *C. collinitus* based on the make up of the stalk rings and smaller spore size, which these collections match closely.

***Laccaria trullisata* (Ellis) Pk.** (Tricholomataceae)

20 Sep 1997, Site 8, ten fruiting bodies, *hmc-97-023* (Fig. 3); 28 Aug 1998, Site 8, occasional; 25 Sep 1998, Site 8, frequent; 26 Sep 1999, Site 8, abundant; 21 Sep 2000, Site 8, occasional; 20 Sep 2001, Site 8, abundant.

Fruiting body fleshy, purple overall; height 6.0–14.4 cm; pileus 3.2–8.0 cm; stipe thickened at base; on ground; this species is mycorrhizal; a robust mushroom always found in deep sand; Redhead (1989) says its distribution is linked to ocean beaches and Great Lakes shores, but this collection is from an inland lake; the author has found it as far inland as central Wisconsin; Bessette et al. (1997) report it as fairly common, however Smith et al. (1979) say not commonly collected.

***Lactarius paradoxus* Beards. & Burl.** (Russulaceae)

28 Aug 1999, Site 6, single fruiting body, *hmc-99-023*.

Fruiting body fleshy, greenish-gray overall; height 6.2 cm; pileus 6.8 cm; gills exude red latex turning green; this species is mycorrhizal; cited by Bessette et al. (1997) as occasional; Smith et al. (1979) say “fairly abundant in southeast under



FIGURE 3. *Laccaria trulisatta* (Ellis) Pk.; *hmc-97-023*; 20 Sep 1997, in deep sand, often on beaches, among red oak and pines with which it is mycorrhizal.

cabbage palmetto, but less frequent to rare northward”; Helsler and Smith (1979) also assign this mushroom a more southerly distribution.

***Laetiporus huroniensis* Burds. & Banik (Coriolaceae)**

29 Aug 1998, T52N, R28W, Sec 20, W of Pine Lake, hemlock log, multiple overlapping fruiting bodies, *hmc-98-007* (this collection sent fresh to the Forest Products Lab, Madison, WI for species determination (see below)); 26 Sep 1998, T52N, R28W, Sec 20, W of Pine Lake, hemlock log, multiple overlapping fruiting bodies, *hmc-98-011* (deposited as *L. sulphureus* (Bull. ex Fr.) Bondarzew & Singer in MICH (#39051)) (Fig. 4); 24 Aug 2002, T52N, R28W, Sec 20, W of Pine Lake, hemlock log, multiple overlapping fruiting bodies, *hmc-02-011*.

Fruiting body fleshy to woody in age; pileus shelving, overlapping 12.0–25.0 cm wide × 6.0–12.0 cm deep; individual fronds 0.5–2.4 cm thick, yellow to orange, zoned; pores bright yellow; on wood; this saprotrophic species causes a brown rot of conifer wood especially hemlock; the species was newly described (Burd-sall & Banik 2001) and named for the Huron Mountains where some of the first collections were made (*hmc-98-007*, and in 1999 by M. Banik (Burd-sall & Banik 2001)); previously this species had been grouped with *L. sulphureus* which decays hardwoods, especially oak, which has also been observed by the author in the Huron Mountains; the only other documented collections of *L. huroniensis* are from old-growth hemlock in the Sylvania Wilderness, Gogebic Co., MI (Burd-sall & Banik 2001); the author has observed it in the same location in the

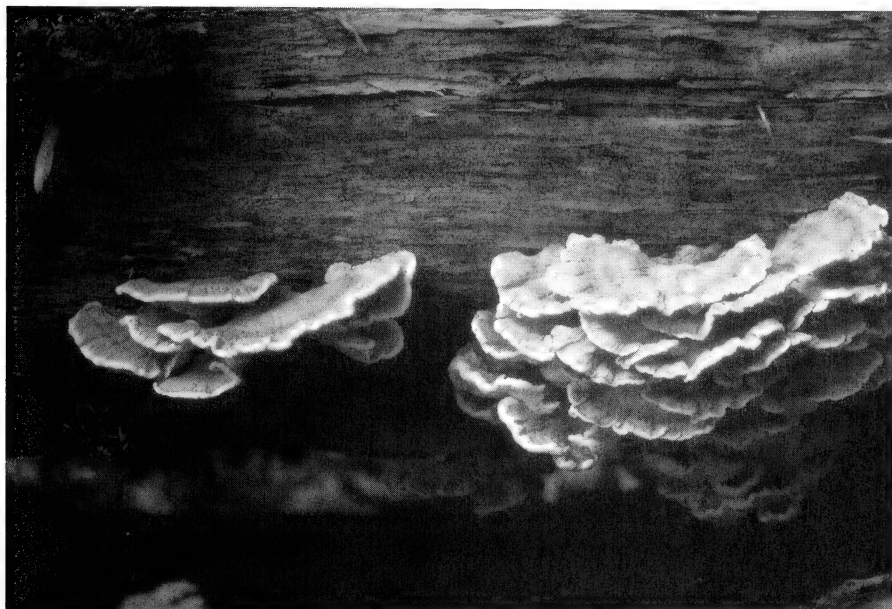


FIGURE 4. *Laetiporus huroniensis* Burdsall & Banik; hmc-98-011 and MICH 39051; 26 Sep 1998; on downed eastern hemlock log where it causes a brown-rot decay; this sulfur-shelf mushroom was recently named a separate species, partly based on this collection.

Huron Mountains but not collected it 24 Aug 1999, 26 Aug 2000, 23 Aug 2001, 22 Aug 2002; the common name for this mushroom is the “sulphur shelf,” the most commonly eaten polypore (Gilbertson & Ryvarden 1986); *L. huroniensis* has been eaten and enjoyed by the author and others on several occasions with no ill effects, although the sulphur shelf *sensu lato* has been reported to cause sickness when collected from conifer wood (Bessette et al. 1997).

***Oligoporus obductus* (Berk.) Gilb. & Ryv. (Coriolaceae)**

Synonym *Osteina obducta* (Berk.) Donk.; *Polyporus osseus* Kalchbr.

20 Sep 1997, T52N, R28W, Sec 34, N edge of Third Pine Lake, hemlock woods, single large, joined clump of fruiting bodies, hmc-97-021 (Fig. 5).

Fruiting body fleshy but hard in age; height 5.3–13.0 cm; joined surface of pileus 26.0×15.0 cm in total, tan to light red-brown; pores off-white to buff, descending joined stipes; on ground; this is a saprotrophic species causing a brown rot of conifer wood (Gilbertson & Ryvarden 1986); although this collection was fruiting out of the ground it was likely decaying hemlock roots; known as the bone polypore (Phillips 1991) because of its hardness when dried; more common in W North America on Douglas fir (Gilbertson & Ryvarden 1986); this mushroom is

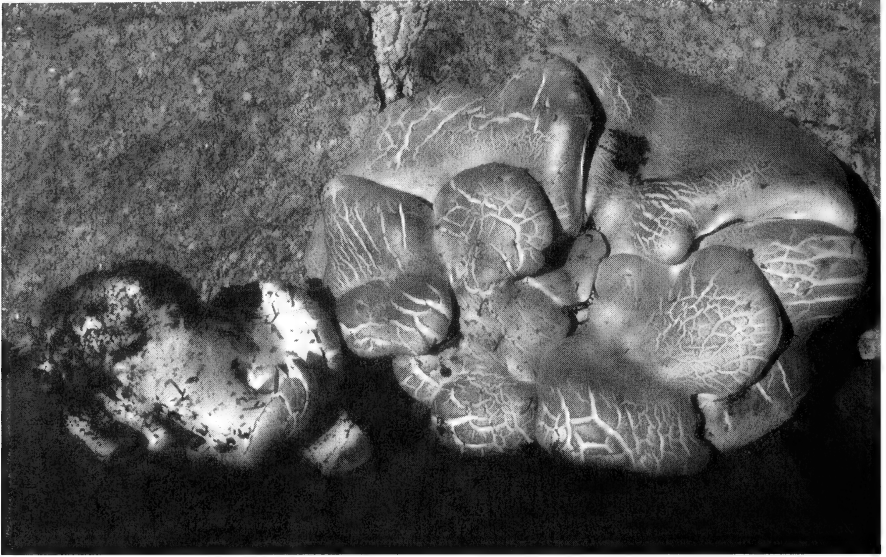


FIGURE 5. *Oligoporus obductus* (Berk.) Gilb. & Ryv.; hmc-97-021 and MICH 39086; 20 Sep 1997; on ground in hemlock forest, where it causes a brown-rot decay of conifer wood.

poorly represented in mushroom field guides; this collection deposited in MICH (#39086) as *Osteina obducta* (Berk.) Donk.

***Pleurotus dryinus* (Pers ex Fr.) Kummer** (Tricholomataceae)

26 Aug 2000, T52N, R28W, Sec 34, N of Third Pine Lake, on well decayed maple log, five large (10–20 cm diam.) fruiting bodies, hmc-00-005; 25 Aug 2002, T52N, R28W, Sec 30, N of Mountain Lake, on aspen log, many (> 20) fruiting bodies, three collected, hmc-02-012, (Fig. 6).

Fruiting body fleshy, dull white to yellowish-gray overall; height 8.2–20.0 cm; pileus 5.4–17.8 cm; gills slightly descend off-center stipe; on wood; this saprotroph causes a white-rot of hardwoods; known as the “veiled oyster mushroom” due to the presence of a membranous superior ring on the stalk (Bessette et al. 1997); the true oyster mushroom, *Pleurotus ostreatus* (Jacq. ex Fr.) Kumm., is much more common and one of the most widely collected mushrooms for eating. However, *P. dryinus* is not a quality edible; Bessette et al. (1997) say occasional; Smith et al. (1979) say not common; these fruiting bodies (as observed with fresh specimens of other *Pleurotus* spp.) were infested with “pleasing fungus beetles” (Erotylidae), named for their striking bright red and black elytrae.

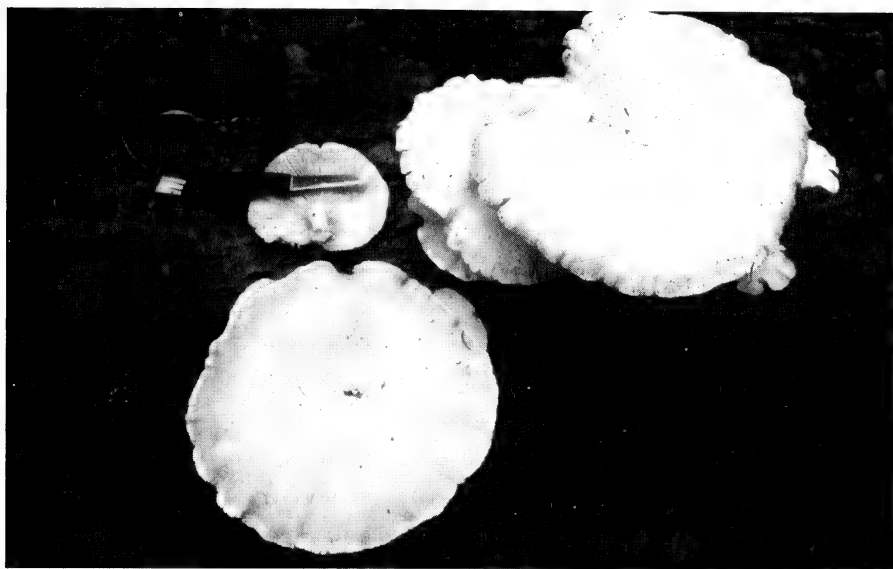


FIGURE 6. *Pleurotus dryinus* (Pers. ex Fr.) Kummer; *hmc-02-012*; on downed aspen log, where it causes a white-rot decay.

***Pulveroboletus ravenelii* (Berk. & Curt.) Murr. (Boletaceae)**

Synonyms *Boletus ravenelii* Berk. & Curt., *Suillus ravenelii* (Berk. & Curt.) Kuntze.

22 Sep 1996, T51N, R28W, Sec 15, along Salmon Trout River near Hogback Falls, mixed conifers and hardwoods, single fruiting body, *hmc-96-032*.

Fruiting body fleshy, bright yellow overall; height 13.2 cm; pileus 5.6 cm; pores bruise blue; stipe with powdery veil remnants; this is a mycorrhizal species; striking in its color and known as the powdery sulfur bolete (Bessette et al. 1999); Smith and Thiers (1971) say it is most abundant in SE U.S., but in Michigan most frequent along the south shore of Lake Superior; Bessette et al. (1999) and Snell and Dick (1970) cite it as occasional; this is the only collection of the species the author has ever made.

***Russula redolens* Burlingham (Russulaceae)**

19 Sept 2002, Site 8, single fruiting body, *hmc-02-013*.

Fruiting body fleshy; height 7.4 cm; pileus 5.2 cm, greenish-gray; gills and stipe white; on ground; this is a mycorrhizal species; the *virescens* group of the genus *Russula* is poorly represented in the mushroom literature; perhaps often misidentified or grouped with *R. virescens* Fr.; the latter has a white spore deposit and slightly larger spores than *R. redolens*, which has a cream deposit (Phillips

1991); Phillips (1991) says rather uncommon; this is the author's only collection of this species.

***Sarcodon underwoodii* Banker** (Thelephoraceae)

28 August 1999, Site 8, single fruiting body, *hmc-99-025*.

Fruiting body fleshy; height 6.8 cm; pileus 8.8 cm, brown with radiating scales; teeth light brown descending darker brown stipe; on ground; a likely mycorrhizal species, as with other hydneaceous fungi occurring on the ground, although research confirming this is lacking; it is poorly represented in the mushroom guides; very similar in appearance to the more common *S. imbricatus* (L. ex Fr.) Karst., also collected in the Huron Mountains (Richter 1996–2003), which has slightly larger and less strongly-warted spores (Phillips 1991, Bessette 1997); Phillips (1991) says rare; Bessette et al. (1997) say uncommon.

***Scleroderma septentrionale* Jeppson** (Sclerodermataceae)

30 Aug 1996, T52N, R28W, Sec 21, W of mouth of Pine River, shore of Lake Superior, paper birch, red oak, white and red pine, eight fruiting bodies, *hmc-96-014*; 20 Sep 1997, Site 8, two fruiting bodies, *hmc-97-026*; 25 Sep 1998, Site 8, occasional; 22 Sep 2000, Site 1, 12 fruiting bodies, *hmc-00-010*; 17 Sep 2003, T52N, R28W, Sec 21, W of mouth of Pine River, shore of Lake Superior, paper birch, red oak, white and red pine, four fruiting bodies, *hmc-03-019*.

Fruit body a rigid puffball; total length 7.2–14.4 cm; 2.0 to 8.0 cm diam., dull-yellow; pseudostipe short and fibrous to long and deeply rugose; this is a mycorrhizal species (Richter & Bruhn 1989); a rather unattractive puffball found in deep sand; reported as *S. meridionale* in 1996 and 1997 HMWF reports (Richter 1996, 1997); there is much confusion in the literature surrounding the name of this species; Smith (1951) illustrates specimens that are clearly this species referring to them as *S. aurantium* Pers. "form from sand dunes"; in a monograph of the genus, Guzmán (1970) refers to it as *S. macrorrhizon* Wall.; Smith et al. (1981) in their 1973 edition use the latter name as well, but in the later edition use *S. meridionale* Demoulin & Malençon, apparently in response to a correction published by Demoulin (1974); Jeppson (1998) described the northern variation with slightly larger spores as *S. septentrionale* Jeppson; Guzmán and Ovrebo (2000) greatly clarify the differences between *S. meridionale* and *S. septentrionale* and reassign earlier determinations of some of Richter's (1992) northern Michigan collections to the latter species; descriptions based on immature collections of fruiting bodies also adds to confusion within the genus, as spore measurements taken from these are not representative of the species; diameter of spores of the collections from the Huron Mtns. measure (n=10, including spines) 12–18 μm , 15–22 μm , 12–17 μm , 12–19 μm , respectively for the four collections (with spines 1–3 μm); these measurements conform nicely to Guzmán and Ovrebo (2000) *S. septentrionale*; the species is rarely reported in the mushroom literature, although the earlier name, *S. meridionale* appears in Bessette et al.



FIGURE 7. *Tricholoma magnivalare* (Pk.) Redhead; hmc-01-027; 20 Sep 2001; among jack pines and red pines, with which it is mycorrhizal.

(1997) and Smith et al. (1981); the most common of the genus is known as the pigskin poison puffball, *S. citrinum* Pers. (Lincoff 1981, Bessette et al. 1997).

***Tricholoma magnivalare* (Pk.) Redhead (Trichlomataceae)**

Synonym *Armillaria ponderosa* Pk.

21 Sep 1996, Site 1, single fruiting body, hmc-96-026; 19 Sep 1997, Site 4, three fruiting bodies, hmc-97-015a; 19 Sep 1997, Site 6, two fruiting bodies, hmc-97-015b; 19 Sep 1997, Site 8, frequent; 25 Sep 1998, Site 8, occasional; 26 Sep 1999, Site 8, frequent; 20 Sep 2001, Site 1, occasional; 20 Sep 2001, Site 6, occasional; 20 Sep 2001, Site 8, three fruiting bodies, hmc-01-027, (Fig. 7); 21 Sep 2002, Site 4, two fruiting bodies, hmc-02-022; 21 Sep 2002, Site 5, single fruiting body, hmc-02-023; 21 Sep 2002, Site 8, occasional.

Fruiting body fleshy; height 5.8–11.0 cm; pileus 6.2–18.4 cm, white to light yellowish-brown; gills white; stipe yellow-brown with veil; likely a mycorrhizal species, and cited as such by Redhead (1989), although as far as is known, pure culture synthesis to confirm this is lacking, probably due to the inability of the fungus to grow in culture; numerous attempts to culture fresh fruit body tissue from these collections have been unsuccessful; a robust, firm, cream-colored mushroom with a sharp fragrance; more common in western North America (Miller 1980, Redhead 1989); cited as uncommon in the northeast (Bessette et



FIGURE 8. *Volvariella bombycina* (Schaeff. ex Fr.) Singer; *hmc-02-009*; 23 Aug 2002; on a downed maple log, where it causes a white-rot decay.

al. 1997); edible and known as the American Matsutake or White Matsutake, collected in the west under Douglas fir and Ponderosa pine for export to Japan (Redhead 1989, Bessette et al. 1997); in northern Michigan it is as highly prized and as sought after by collectors in the fall as the morel mushroom is in the spring; *Armillaria ponderosa* Pk., is the name used in early HMWF reports (Richter 1996, 1997).

***Volvariella bombycina* (Schaeff. ex Fr.) Singer (Pluteaceae)**

23 Aug 2002, T52N, R28W, Sec 27, SW of Cranberry Bog, maple log, two fruiting bodies, *hmc-02-009*, (Fig. 8).

Fruiting body fleshy; height 8.2–12.6 cm; pileus 5.4–9.2 cm, silky-white, fibrillose; gills off-white; stipe white, enclosed at base by a membranous, light brown volva remaining intact when mature; on wood; a strikingly beautiful mushroom causing a white-rot of hardwoods; Burdsall (1974) reported it from the Huron Mountains on maple near Ives Lake (col. #8241); Dr. William Manierre (personal communication) also found it near Mountain Lake 28 Aug 1989; Miller (1980) says rare; Bessette et al. (1997) say occasional; Lincoff (1981) says not common; curiously it is not included in Phillips (1991), perhaps due to its rarity; this is only the second time the author has encountered it.

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The Huron Mountain Wildlife Foundation provided funding and facilities; Michigan Technological University provided lab space and equipment; discussions with Dr. and Mrs. W. R. Manierre and Dr. D. C. L. Gosling regarding the ecology and fungi of the Huron Mountain forests added greatly to this work; Dr. Harold H. Burdsall, Jr. is thanked for providing valuable comments and assistance with the manuscript; the Huron Mountain Club is gratefully acknowledged for maintaining these forests for research.

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A THIRTY-YEAR STUDY OF THE VASCULAR PLANTS OF "BUTTERNUT PINES," A 40-ACRE TRACT IN OCONTO COUNTY, WISCONSIN

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"Microfloras"—detailed floristic inventories of 1–100 ha "plots"—are a useful way of sampling floristic and vegetational diversity on a regional scale. They help document the effects of global climate change on plant ranges; local extirpation and colonization of species due to stochastic effects; the effects of white-tailed deer herbivory on vulnerable taxa such as lilies and orchids; document changing land use patterns including successional trends from agricultural land to second-growth forests; help to measure more accurately the true abundance and distribution of elusive or "fugitive" species such as grape-ferns (*Botrychium* spp.) and some small orchids; and help gauge the overall thoroughness of statewide floristic inventories by uncovering "disjuncts" and range outliers. Aside from all of these serious reasons is the pleasure of walking and re-walking a much-loved piece of the earth where time and happenstance frequently bring floristic surprises.

Here I present the results of a 30-year survey of a small tract with diverse habitats and plant communities in northeastern Wisconsin. "Butternut Pines" comprises 40 acres (16 ha) owned by the author and Wyat D. Judziewicz in Oconto County, Wisconsin (Town of Breed, T30N-R17E, Sec. 14). It is located about 70 km northwest of the city of Green Bay and 60 km west of Marinette, Wisconsin and Menominee, Michigan.

METHODS

I monitored the vascular flora intensively from 1975 until 1979, spending about 500 hours in the field and searching nearly every square meter of the tract at least once. About 500 plant species had been recorded by the end of 1979. My annual surveys were not nearly as intensive from 1980–2004. During that period an average of about one new species per year was added to the flora: mostly exotics along Logan Road and the driveway, but also a few natives that had been overlooked or that had naturally colonized the tract over that period. Also, this important caveat must be added: It was much easier to record and date the first appearance of a species, much more difficult to notice exactly when a species dropped out of the flora!

All collections are mine. Unless noted, there are deposited in the Wisconsin State Herbarium in Madison (WIS); plus a few in the UW-Stevens Point Robert W. Freckmann Herbarium (UWSP), and a few in a small herbarium at the Wisconsin Department of Natural Resources ranger station in Brule, Douglas County. Nomenclature follows Wetter et al. (2001).

GEOLOGY AND GEOGRAPHY

1.6 billion year old Belongia granite (Greenberg & Brown 1984) underlies the tract but does not outcrop. At the cabin (elevation 827 feet above sea level), a well, drilled in 1992, encountered bedrock at 49 feet below the surface (778 feet), or 32 feet below the normal level of the North Branch of the Oconto River (810 feet), which runs through the tract from southwest to northeast. The property is covered by clayey-sandy glacial drift deposited by Wisconsin glaciation. An abandoned post-glacial river channel (perched 3 meters above the level of the present river), the "Slough," occurs just south of a town road on the north side of the river and encloses the cabin on an almond-shaped, approximately 2.5 ha "island." The present river, normally about 15–20 meters wide and 0.8–1.5 meters deep near the cabin, is still re-shaping the landscape of the tract, cutting into glacial drift on outside curves to form steep banks, and depositing rich silty soil on the inner curves on terraces (the "East and West Shelves"). Springy, apparently somewhat calcareous seeps occur along the banks at several places ("Carex Springs" and "Hawthorn Glen"). South of the river are the rolling "South Fields," now filling up rapidly with pines of various species, quaking aspen, white birch, and red maple. Here the highest point on the tract occurs (ca. 855 feet). In the extreme southeast corner are the "Ice Ponds," a pair of tiny glacial kettles. The upland soils are mostly medium-grained sand, with some clay; drift boulders are uncommon, but the soils are acid and deficient in phosphorus and potassium (Agriculture and Conservation Stabilization Service survey conducted in 1955).

CLIMATE

The tract is characterized by mild summers and cold winters; the average annual temperature is 43° F., with a January average of 16° and a July average of 70°; average annual extreme temperatures vary from about –25° to 95°. The frost-free season is from about late May to mid-September; precipitation averages 29", with 47" in the form of snow (U.S. Weather Service data from Breed, 6 km west-southwest of the tract). On 28 February 1996 I recorded a minimum temperature of –47° F. at the cabin.

HISTORY

Thomas Simpson of the General Land Office Survey visited the tract on 20 October 1855 and recorded two hemlocks (*Tsuga canadensis* (L.) Carrière), diameters 7" and 8" d.b.h., as witness trees at the Section corner at the northeast corner of the tract—where he and his crew apparently camped for the night. He also noted that beech (*Fagus grandifolia* Ehrh.) and white pine (*Pinus strobus* L.) were common in the area. The first white "owner" was Alex Davis in 1888 (title search conducted by the Hall Abstract Co. of Oconto, Wisconsin, in 1954).

Davis and his wife were soon divorced and the title passed to their son Richard in 1890. At this time Mrs. Davis obtained a court order preventing her husband from cutting any timber, so the vegetation must have included large trees. Delinquent taxes returned the tract to the county in 1897, so perhaps the trees had been cut anyway in the intervening seven years. Large, charred, white pine stumps north of the river (especially along the eastern end of the Slough), attest to post-logging fires. A succession of owners now owned the land, until 1914, when Otto Schultz (1868–1945) bought it on land contract from the Oconto Land Company. It remained in his family for forty years. Otto and his wife Olivia (1880–1964) built a farmstead (1920) not far away (Sec. 12, NW¼ of SW¼) and used the tract for hay and pasturage; the land south of the river was probably cleared in the 1920's. A neighbor, Kenneth Piso (1933–1999) remembers that, as a boy, he frequently heard old Otto “swearing at his cows” as he urged them to cross the river to pasturage to the south. He also recalls farmers in the immediate area finding large numbers of Indian arrowheads in the soil (Perhaps an indicator, along with the abundance of butternuts, that the tract was an important aboriginal campsite, given its location just below a “fall line” on the Oconto River). After Otto died, the farm and tract passed to his son Ervin (1906–1950) and his wife Katherine (b. 1909). Ervin was killed in an automobile accident one mile away, and Katherine sold the tract to Louis J. (1921–1995) and Lucinda (b. 1921) Judziewicz in 1954. The South Fields were hayed until 1954, and Louis planted the scotch pine (*Pinus sylvestris* L.) plantation south of the river in 1956, and the red pine (*P. resinosa* Aiton) plantation north of the river along the road in 1957. He built the present cabin (Fig. 1) on the tract in 1963–1964. Later his son Wyatt (b. 1956) built a garage (1981) and a log sauna (1984).

VEGETATION

Curtis (1971) and Finley (1976) mapped the original vegetation of the tract as consisting of beech, hemlock, sugar maple (*Acer saccharum* Marshall var. *saccharum*), yellow birch (*Betula alleghaniensis* Britton), and white pine, and, as noted, the first surveyor found three of these species here in 1855.

Mixed second-growth woods. Large areas north of the river and a narrow band just southwest of the river are dominated by a heterogeneous mixture of tree species. White birch (*Betula papyrifera* Marshall) and white pine are co-dominant, while quaking aspen (*Populus tremuloides* Michx.), bigtooth aspen (*P. grandidentata* Michx.), red maple (*Acer rubrum* L. var. *rubrum*), hemlock, and red oak (*Quercus rubra* L.) are all common. Butternut (*Juglans cinerea* L.) was common and had good regeneration up until the 1990's when disease began killing them off. In spite of high white-tailed deer populations, there is good regeneration of most species, principally white pine and red oak, but also even hemlock and white cedar in spots. Most trees are in the range of 10–30 cm d.b.h., but the white pines around the cabin commonly exceed 60 cm and a few oaks attain 100 cm. Among other upland tree species, beech is present as only a few saplings, white spruce (*Picea glauca* (Moench) Voss) as one riverside tree, and



FIGURE 1. The old butternut (*Juglans cinerea*) in March 1994, with the cabin surrounded by white pines (*Pinus strobus*) in the background. The butternut was nearly dead in 2004.

balsam-fir (*Abies balsamea* (L.) Mill.) as an occasional sapling or small tree. The understory is often brushy and difficult to walk through comfortably because of abundant prickly-ash (*Zanthoxylum americanum* Mill.), brambles (*Rubus* spp.), staghorn sumac (*Rhus hirta* (L.) Sudw.), common scouring-rush (*Equisetum hyemale* (L.) subsp. *affine* (Engelm.) Calder & Roy L. Taylor), and thickets of ironwood (*Carpinus caroliniana* Walter). The commonest understory species are bracken fern (*Pteridium aquilinum* (L.) Kuhn. var. *latiusculum* (Desv.) A. Heller), spinulose wood fern (*Dryopteris carthusiana* (Vill.) H.P. Fuchs), starflower (*Trientalis borealis* Raf. subsp. *borealis*), Canada mayflower (*Maianthemum canadense* Desf.), corn-lily (*Clintonia borealis* (Aiton) Raf.), white violet (*Viola macloskeyi* F.E. Lloyd subsp. *pallens* (Ging.) M.S. Baker), wild sarsaparilla (*Aralia nudicaulis* L.), whorled loosestrife (*Lysimachia quadrifolia* L.), cow-wheat (*Melampyrum lineare* Desr.), fringed milkwort (*Polygala paucifolia* Willd.), wood anemone (*Anemone quinquefolia* L. var. *quinquefolia*), Penn sedge (*Carex pensylvanica* Lam.), white lettuce (*Prenanthes alba* L.), Canada hawkweed (*Hieracium kalmii* L.), lopseed (*Phryma leptostachya* L.), calico aster (*Aster lateriflorus* (L.) Britton), big-leaved aster (*A. macrophyllus* L.), azure aster (*A. oolantangiensis* Riddell), and field pussytoes (*Antennaria howellii* Greene subsp. *neodioica* (Greene) R.J. Bayer); common shrubs are Canada honeysuckle (*Lonicera canadensis* Marshall), beaked hazelnut (*Corylus cornuta* Marshall subsp. *cornuta*), and pagoda dogwood (*Cornus alternifolia* L.f.).

West of the cabin the understory is drier and a bit more open and hemlock and white pine are dominant. Here in addition to the above are found rice-grass (*Oryzopsis asperifolia* Michx.), sedges (*Carex communis* L.H. Bailey, *C. gracillima* Schwein, *C. pedunculata* Willd., and *C. pensylvanica*), wood rush (*Luzula acuminata* Raf. var. *acuminata*), rosy twisted-stalk (*Streptopus roseus* Michx. var. *longipes* (Fernald) Fassett), maidenhair fern (*Adiantum pedatum* L.), sweet cicely (*Osmorhiza claytonii* (Michx.) C.B. Clarke), enchanter's-nightshade (*Circaea alpina* L. var. *alpina*), naked mitrewort (*Mitella nuda* L.), shinleaf (*Pyrola elliptica* Nutt.), goldthread (*Coptis trifolia* (L.) Salisb.), red baneberry (*Actaea rubra* (Aiton) Willd.), wintergreen (*Gaultheria procumbens* L.), lady fern (*Athyrium filix-femina* (L.) Mert. var. *angustum* (Willd.) G. Lawson), spinulose wood fern, rattlesnake fern (*Botrychium virginianum* (L.) Sw.), and four club-mosses (*Lycopodium annotinum* L., *L. clavatum* L., *L. dendroideum* Michx., and *Diphasiastrum digitatum* (A. Braun) Holub). Shrubs include partridge-berry (*Mitchella repens* L.), northern bush-honeysuckle (*Diervilla lonicera* Mill.), red-berried elder (*Sambucus racemosa* L. subsp. *pubens* (Michx.) House), arrow-leaved viburnum (*Viburnum acerifolium* L.), and witch-hazel (*Hamamelis virginiana* L.).

The steep, dry, south-facing piney bank southwest of the cabin ("Leaning Pine") has species found nowhere else on the tract, including northern bedstraw (*Galium boreale* L.), harebell (*Campanula rotundifolia* L.), starry false Solomon's-seal (*Smilacina stellata* (L.) Desf.), and small rice-grass (*O. pungens* (Spreng.) Hitchc.) as well as common tall shrubs such as juneberries (*Amelanchier* spp.) and pin cherry (*Prunus pensylvanica* L.f.). Where these sunny banks flatten out slightly to the east, the river shores are dominated by balsam-

poplar (*Populus balsamifera* L. subsp. *balsamifera*), red-osier dogwood (*Cornus stolonifera* Michx.), and ninebark (*Physocarpus opulifolius* (L.) Maxim.), plus a single large cottonwood (*Populus deltoides* Marshall subsp. *monilifera* (Aiton) Eckenw.). The following species also occur: rough hedge-nettle (*Stachys tenuifolia* Willd. var. *tenuifolia*), virgin's-bower (*Clematis virginiana* L.), marsh vetchling (*Lathyrus palustris* L.), rough-leaved goldenrod (*Solidago patula* Willd. var. *patula*), wild grape (*Vitis riparia* L.), and wild yam (*Dioscorea villosa* L.). The opposite (southwest) bank of the river has a few pine forest species such as trailing arbutus (*Epigaea repens* L.), wood rush (*Luzula multiflora* (Retz.) Lejeune subsp. *multiflora*), wintergreen, and lowbush blueberry (*Vaccinium angustifolium* Aiton).

Rich mesic woods. These are restricted to the deep, black-soiled terraces or "Shelves" next to the river on the west and especially east ends of the tract. The East Shelf has the most protected, mesic habitat on the tract; the dominant trees are sugar maple and yellow birch, along with black ash (*Fraxinus nigra* Marshall) and white cedar on the immediate riverbank and climbing bittersweet (*Celastrus scandens* L.) twining among the branches hanging over the river. Herbs found here, often only as a few individuals, include wild ginger (*Asarum canadense* L.), jack-in-the-pulpit (*Arisaema triphyllum* (L.) Schott var. *triphyllum*), bishop's-cap (*Mitella diphylla* L.), horse-gentian (*Triosteum aurantiacum* E.P. Bicknell), toothwort (*Cardamine diphylla* (Michx.) A.W. Wood), skunk cabbage (*Symplocarpus foetidus* (L.) W.P.C. Barton), blue cohosh (*Caulophyllum thalictroides* (L.) Michx.), large-flowered bellwort (*Uvularia grandiflora* Sm.), hairy-leaved sedge (*Carex hirtifolia* Mack.), nodding trillium (*Trillium cernuum* L.), shade horsetail (*Equisetum pratense* Ehrh.), MacKay's brittle fern (*Cystopteris tenuis* (Michx.) Desv.), enchanter's-nightshade (*Circaea lutetiana* L. subsp. *canadensis* (L.) Asch. & Magnus), bloodroot (*Sanguinaria canadensis* L.), yellow violet (*Viola pubescens* Aiton), spikenard (*Aralia racemosa* L.), bottlebrush grass (*Elymus hystrix* L.), dwarf ginseng (*Panax trifolius* L.), and several woodland grasses (*Brachyelytrum erectum* (Spreng.) P. Beauv., *Festuca subverticillata* (Pers.) E.B. Alexeev, and *Milium effusum* L.). The north-facing "escarpment" above the Shelf is dominated by hemlocks and maples with bunchberry (*Cornus canadensis* L.), corn-lily, oak fern (*Gymnocarpium dryopteris* (L.) Newman), woodreed (*Cinna latifolia* (Göpp.) Griseb.), and shining clubmoss (*Huperzia lucidula* (Michx.) Trevis.) in the understory.

The West Shelf woods has grove sandwort (*Arenaria lateriflora* L.), columbine (*Aquilegia canadensis* L.), Virginia spring-beauty (*Claytonia virginica* L. var. *virginiana*), wild garlic (*Allium canadense* L. var. *canadense*), late meadow-rue (*Thalictrum dasycarpum* Fisch. & Avé-Lall), pale vetchling (*Lathyrus ochroleucus* Hook.), northern bugleweed (*Lycopus uniflorus* Michx.), Canada moonseed (*Menispermum canadense* L.), zigzag goldenrod (*Solidago flexicaulis* L.), tussock sedge (*Carex stricta* Lam.), dodder (*Cuscuta gronovii* Roem. & Schult. var. *gronovii*), and gray dogwood (*Cornus racemosa* Lam.).

At a small rapids on the north side of the river are dense thickets of ironwood, prickly-ash, hawthorn (*Crataegus punctata* Jacq.), basswood (*Tilia americana* L.), green ash (*Fraxinus pennsylvanica* Marshall), silver maple (*Acer saccharinum* L.), balsam-poplar, and mesic species such as great white trillium (*Trillium*

grandiflorum (Michx.) Salisb.), bloodroot, Virginia spring-beauty, wild leek (*Allium tricoccum* Aiton var. *tricoccum*), round-lobed hepatica (*Anemone americana* (DC.) H. Hara), hops (*Humulus lupulus* L. var. *lupuloides* E. Small), green-briers (*Smilax* spp.), and the ubiquitous hog-peanut (*Amphicarpaea bracteata* (L.) Fernald). In the far northeastern corner of the tract is a steep, mesic riverbank with sugar maple, yellow birch, round-leaved dogwood (*Cornus rugosa* Lam.), a few plants of wild geranium (*Geranium maculatum* L.), large intermixed colonies of ground-nut (*Apios americana* Medik.) and poison-ivy (*Toxicodendron rydbergii* (Rydb.) Greene), and, along the river, woodreed (*Cinna arundinacea* L.).

A few hundred meters east of the tract, in the river bottoms, occur green dragon (*Arisaema dracontium* (L.) Schott), bladdernut (*Staphylea trifolia* L.), and woolly violet (*Viola sororia* Willd.).

Mixed conifer slope forest. The steep, northwest-facing riverbanks on the southeast side of the river (Fig. 2) have a dense forest of mixed white cedar (*Thuja occidentalis* L.), hemlock, white pine, yellow birch, and white birch. Distinctive understory species here are common polypody (*Polypodium virginianum* L.; Fig. 3), dwarf scouring-rush (*Equisetum scirpoides* Michx.), greenish-flowered pyrola (*Pyrola chlorantha* Sw.), early coral-root (*Corallorhiza trifida* Châtel.), northern green orchid (*Platanthera huronensis* (Nutt.) Lindl.), red-berried elder, and, formerly, mountain maple (*Acer spicatum* Lam., Fig. 4). A rare moss, bug-on-a-stick (*Buxbaumia aphylla* Hedw.), was also collected from this slope in 1993; the thallose liverwort *Conocephalum conicum* (L.) Dumort. is dominant near the water's edge.



FIGURE 2. North Branch of the Oconto River on the tract, 2 February 2002. A view of the south bank, which has mix of white pine, hemlock, and white cedar. All 12 species of aquatic macrophytes present in the river in the late 1970s were gone by 1995.



FIGURE 3. Steep, north-facing south bank of the river, 7 August 2001. Shaded by hemlocks, a colony of polypody fern (*Polypodium virginianum*) can be seen on the right. This is also the habitat for the rare bug-on-a-stick moss (*Buxbaumia aphylla* Hedw.).

Seeping riverside meadows. These areas are small, amounting in total to only a few hundred square meters, but have very diverse floras. Hawthorn Glen has many sedges (*Carex bebbii* (L.H. Bailey) Fernald, *C. intumescens* Rudge, *C. stipata* Willd.), spotted touch-me-not (*Impatiens capensis* Meerb.), ostrich fern (*Matteuccia struthiopteris* (L.) Todaro var. *pensylvanica* (Willd.) C.V. Morton), flat-topped aster (*Aster umbellatus* Mill.), agrimony (*Agrimonia gryposepala* Wallr.), purple fringed orchid (*Platanthera psycodes* (L.) Lindl.), great lobelia (*Lobelia siphilitica* L.), marsh bellflower (*Campanula aparinoides* Pursh), purple-leaved willow-herb (*Epilobium coloratum* Biehler), great St. John's-wort (*Hypericum pyramidatum* Aiton), wool-grass (*Scirpus cyperinus* (L.) Kunth), golden saxifrage (*Chrysosplenium americanum* Hook.), skunk cabbage, false-nettle (*Boehmeria cylindrica* (L.) Sw.), stinging nettle (*Urtica dioica* L. subsp. *gracillis* (Aiton) Selander), side-flowered skullcap (*Scutellaria lateriflora* L.), swamp dock (*Rumex verticillatus* L.), and even a colony of the moss *Sphagnum russowii* Warnst. Just east of Hawthorn Glen the second-growth woods are rich in sedges (*Carex arctata* Hook., *C. brunnescens* (Pers.) Poir. subsp. *sphaerostachya* (Tuck.) Kalela, *C. castanea* Wahlenb., *C. cephaloidea* (Dewey) Dewey, *C. debilis* Michx. var. *rudgei* L.H. Bailey, and *C. deweyana* Schwein. subsp. *deweyana*), purple twayblade (*Liparis lilifolia* (L.) Lindl.), and honewort (*Cryptotaenia canadensis* (L.) DC. occur.

Directly in front (south of) the cabin is a riverbank meadow and springy area



FIGURE 4. Single plant of mountain maple (*Acer spicatum*) on shaded south bank of river, July 1984. This species and twinflower (*Linnaea borealis*) disappeared from the tract by 1990.

with southern sedge meadow and wet prairie elements. The colorful flora includes green-headed coneflower (*Rudbeckia laciniata* L.), great lobelia, cardinal flower (*Lobelia cardinalis* L.), purple fringed orchid, swamp lousewort (*Pedicularis lanceolata* Michx.), turtlehead (*Chelone glabra* L.), false dragonhead (*Physostegia virginiana* (L.) Benth. subsp. *virginiana*), calico, panicled, and flat-

topped asters, closed gentian (*Gentiana andrewsii* Griseb. var. *andrewsii*), bone-set (*Eupatorium perfoliatum* L. var. *perfoliatum*), turk's-cap lily (*Lilium michiganense* Farw.), American brooklime, sneezeweed (*Helenium autumnale* L. var. *autumnale*), Canada anemone (*Anemone canadensis* L.), swamp milkweed (*Asclepias incarnata* L. subsp. *incarnata*), spotted water-hemlock (*Cicuta maculata* L.), swamp buttercup (*Ranunculus hispidus* Michx.), blue flag (*Iris versicolor* L.), golden ragwort (*Packera aurea* (L.) A. Löve & D. Löve), early meadow-rue (*Thalictrum dioicum* L.), fowl manna-grass (*Glyceria striata* (Lam.) Hitchc.), fowl meadow-grass (*Poa palustris* L.), Virginia wild-rye (*Elymus virginicus* L.), and sedges (*Carex aurea* Nutt., *C. castanea*, *C. granularis* Willd., and *C. hystericina* Willd.).

The Slough. The "Slough," the abandoned river channel north of the river, has a diverse wetland flora. At its far western end is a shaded, dead American elm (*Ulmus americana* L.) swamp with marsh marigold (*Caltha palustris* L.) and woodland horsetail (*Equisetum sylvaticum* L.) in the understory. Farther east the Slough begins to be dominated by speckled alders (*Alnus incana* (L.) Moench subsp. *rugosa* Du Roi) R.T. Clausen) along with spotted touch-me-not, purple-stemmed aster (*Aster puniceus* L.), panicked aster (*A. lanceolatus* Willd.), cut-leaved water-horehound (*Lycopus americanus* W.P.C. Barton), crested wood fern (*Dryopteris cristata* (L.) A. Gray), marsh fern (*Thelypteris palustris* Schott var. *pubescens* (Lawson) Fernald), rice cut-grass (*Leersia oryzoides* (L.) Sw.), stiff bedstraw (*Galium tinctorium* L.), dwarf raspberry (*Rubus pubescens* Raf.), bog willow-herb (*Epilobium leptophyllum* Raf.), water avens (*Geum rivale* L.), goldthread, common rush (*Juncus effusus* L.), blue-joint (*Calamagrostis canadensis* (Michx.) P. Beauv.), tall manna-grass (*Glyceria grandis* S. Watson), and various sedges (*Carex canescens* L., *C. crawfordii* Fernald, *C. gynandra* Schwein., *C. disperma* Dewey, *C. hystericina*, *C. retrorsa* Schwein. and *C. vesicaria* L.). North of the garage the alders are joined by willows (*Salix discolor* Muhl. and *S. lucida* Muhl. subsp. *lucida*) and several other shrubs including American gooseberry (*Ribes americanum* Mill.), swamp red currant (*R. triste* Pall.), and nannyberry (*Viburnum lentago* L.). Still farther east (just west of the driveway crossing) is the wettest part of the Slough, with some standing water usually present through most of the summer. Common species here are common cat-tail (*Typha latifolia* L.), swamp dock (*Rumex verticillatus* L.), water-parsnip (*Sium suave* Walter), sedges (*Carex tuckermanii* Dewey, *C. lupulina* Willd.), sticktight (*Bidens frondosus* L.), calla-lily (*Calla palustris* L.), water-pepper (*Polygonum hydropiper* L.), and common duckweed (*Lemna minor* L.). Fringing the Slough are cinnamon fern (*Osmunda cinnamomea* L.), interrupted fern (*O. claytoniana* L.), and royal fern (*O. regalis* L. var. *spectabilis* (Willd.) A. Gray). Just east of the driveway, alders are still dominant and are joined by *Carex leptalea* Wahlenb., tearthumb (*Polygonum sagittatum* L.), black chokeberry (*Aronia melanocarpa* (Michx.) Elliott), and winterberry holly (*Ilex verticillata* (L.) A. Gray). At the far east end of the Slough, where it joins the river, is a springy, mossy cedar thicket with several calciphilic species uncommon or absent elsewhere on the tract. Rough-leaved goldenrod, sedges (*Carex aurea*, *C. bromoides* Willd., and *C. interior* L.H. Bailey), spring cress (*Cardamine bulbosa* (Muhl.) Britton, Sterns & Poggenb.), wild ginger, blue flag, water-pennywort (*Hydro-*

cotyle americana L.), bottlebrush grass, swamp thistle (*Cirsium muticum* Michx.), *Juncus dudleyi* Wiegand, *Scirpus microcarpus* J. Presl & C. Presl, *Bromus ciliatus* L., and common St. John's-wort (*Hypericum punctatum* Lam.) all occur in this fenlike seepage area. The liverwort *Conocephalum conicum* (L.) Lind. and the moss *Plagiomnium cuspidatum* (Hedw.) T. Kop. are both abundant, and the uncommon calciphilic mosses *Rhodobryum roseum* (Hedw.) Limpr. and *Dicranum condensatum* Hedw. are present.

Aquatic vegetation of the river. The North Branch of the Oconto River had an aquatic macrophyte flora of about a dozen species in the mid-1970s when I started botanizing the tract. But over the years these species have all disappeared, while I hardly noticed their decline! My last record of a macrophyte in the river is a 1992 collection of *Potamogeton nodosus* Poir., which once formed luxuriant beds directly in front of the cabin. The former macrophyte flora included three or four species of pondweeds (*Potamogeton* spp.), sago pondweed (*Stuckenia pectinata* (L.) Börner), waterweed (*Elodea canadensis* Michx.), wild-celery (*Vallisneria americana* Michx.), coontail (*Ceratophyllum demersum* L.), water-milfoil (*Myriophyllum sibiricum* Kom.), white water-crowfoot (*Ranunculus aquatilis* L.), and water star-grass (*Zosterella dubia* (Jacq.) Small). Three floating lemnaceous aquatic species were also noted during the late 1970s.

In the late summer when water levels are low, especially in very dry years such as 1978, the muddy shores of the river host many interesting species including hedge-hyssop (*Gratiola neglecta* Torr.), false pimpernel (*Lindernia dubia* (L.) Pennell), water-purslane (*Ludwigia palustris* (L.) Elliott), creeping love grass (*Eragrostis hypnoides* (Lam.) Britton, Sterns & Poggenb.), lesser clearweed (*Pilea fontana* (L.) A. Gray), yellow cress (*Rorippa palustris* (L.) Besser), water-starwort (*Callitriche palustris* L.), spikerushes (*Eleocharis* spp.), rice cut-grass, water-plantain (*Alisma triviale* Pursh), arrowhead (*Sagittaria latifolia* L.), monkey flower (*Mimulus ringens* L. var. *ringens*), smartweeds (*Polygonum* spp.), ditch stonecrop (*Penthorum sedoides* L.), bur-reed (*Sparganium emersum* Rehmman), American brooklime (*Veronica americana* Benth.), and several uncommon grasses (*Leersia virginica* Willd., *Sphenopholis intermedia* (Rydb.) Rydb., and *Puccinellia pallida* (Torr.) R.T. Clausen).

Jack pine savanna. In the southeastern corner of the South Field, seedlings from a jack pine plantation (started in the 1950s) on an adjacent property have been strongly invading during the past few decades (Fig. 5). Understory associates in this acid ca. 2-acre "woodland" include ground-cedar (*Diphasiastrum digitatum*), cut-leaved water-horehound, meadowsweet (*Spiraea alba* Du Roi var. *alba*), hardhack (*S. tomentosa* L. var. *rosea* (Raf.) Fernald), lance-leaved violet (*Viola lanceolata* L. var. *lanceolata*), shinleaf, sundrops (*Oenothera perennis* L.), Indian-tobacco (*Lobelia inflata* L.), Greene's rush (*Juncus greenii* Oakes & Tuck.) bristly dewberry (*Rubus hispidus* L.), and a small St. John's-wort (*Hypericum majus* (A. Gray) Britton). Red-stemmed moss (*Pleurozium schreberi* (Brid.) Mitt.) is the dominant groundcover.

Pine plantations. The 5-acre Scotch pine plantation planted in 1956 on the old hay field was nearly totally cut in 1982 (natural regeneration here is quite good and by 2001 "second-generation" Scotch pines were at least 20 feet tall). In the late 1970's through 1981 the semi-open plantation understory was surveyed and



FIGURE 5. Old fields being invaded by jack pine (*Pinus banksiana*) from a nearby plantation, 15 April 2003. A small, seasonally inundated kettle hole or "ice pond" is visible in the foreground. This habitat contains pine barrens species such as Greene's rush (*Juncus greenei*) and lance-leaved violet (*Viola lanceolata*).

discovered to have been invaded by a surprising number of uncommon species including many orchids and pyrolas. Some of these were nodding and slender ladies'-tresses (*Spiranthes cernua* (L.) Rich. and *S. lacera* (Raf.) Raf.), green adder's-mouth (*Malaxis unifolia* Michx.), rattlesnake-plantains (*Goodyera* spp.), Hooker's orchid (*Platanthera hookeri* (A. Gray) Lindl.), purple twayblade, shin-leaf, one-flowered pyrola (*Moneses uniflora* (L.) A. Gray), one-sided pyrola (*Orthilia secunda* (L.) House), and pipsissewa (*Chimaphila umbellata* (L.) W.P.C. Barton subsp. *cisatlantica* (S.F. Blake) Hultén). Tree seedlings in the plantation, presumably introduced by birds, included wild plum (*Prunus americana* Marshall), black chokeberry, mountain-ash (*Sorbus americana* Marshall – the nearest mature tree at least one and perhaps many km away!), beech, bur oak (*Quercus macrocarpa* Michx. var. *macrocarpa*), Bell's honeysuckle (*Lonicera X bella* Zabel), and highbush cranberry (*Viburnum trilobum* Marshall).

In contrast, the 2-acre red pine plantation bordering the town road is in many places nearly devoid of understory vegetation, although in places there is excellent white pine regeneration.

Old fields. The South Fields are dominated by Kentucky bluegrass (*Poa pratensis* L.) but are rapidly being invaded by pines (*P. sylvestris*, *P. banksiana* Lamb., and *P. strobus*), aspens, red maple, shrubby willows (*Salix* spp.), and especially white birch. Common herbaceous species are orange hawkweed (*Hieracium aurantiacum* L.), king-devil (*H. piloselloides* Vill.), rough hawkweed (*H. scabrum* Michx.), Canada goldenrod (*Solidago canadensis* L.), early gold-

enrod (*S. juncea* Aiton), gray goldenrod (*S. nemoralis* Aiton), Canada thistle (*Cirsium arvense* (L.) Scop.), hairy vetch (*Vicia villosa* Roth), clovers (*Trifolium* spp.), timothy (*Phleum pratense* L.), wild strawberry (*Fragaria virginiana* Dcne.), wild bergamot (*Monarda fistulosa* L.), common milkweed (*Asclepias syriaca* L.), ox-eye daisy (*Leucanthemum vulgare* Lam.), rough-fruited cinquefoil (*Potentilla recta* L.), quackgrass (*Elytrigia repens* (L.) B.D. Jacks.), fringed false buckwheat (*Polygonum cilinode* Michx.), hedge bindweed (*Calystegia spithamea* (L.) Pursh), blue vervain (*Verbena hastata* L.), yellow foxtail (*Pennisetum glaucum*), and black-eyed susan (*Rudbeckia hirta* L. var. *pulcherrima* Farw.). Noteworthy local species are Indian paint-brush (*Castilleja coccinea* (L.) Spreng.), whorled milkweed (*Asclepias verticillata* L.), blue-eyed grass (*Sisyrinchium montanum* Greene), leathery grape-fern (*Botrychium multifidum* (S.G. Gmel.) Rupr.), closed gentian, and Case's ladies'-tresses (*Spiranthes casei* Catling & Cruise).

In the drier, sandier, southwestern part of the south fields, the dry prairie species little bluestem (*Schizachyrium scoparium* (Michx.) Nash) is dominant. Also present are abundant clones of sweet fern (*Comptonia peregrina* (L.) J.M. Coult.) as well as hook-spur violet (*Viola adunca* Sm.), purple love grass (*Eragrostis spectabilis* (Pursh) Steud.), Canada blue grass (*Poa compressa* L.), hoary alyssum (*Berteroa incana* (L.) DC.), poverty oat-grass (*Danthonia spicata* (L.) P. Beauv.), ticklegrass (*Agrostis hyemalis* (Walter) Britton, Sterns & Poggenb.), *Carex tonsa* (Fernald) E.P. Bicknell var. *tonsa*), two-flowered cynthia (*Krigia biflora* (Walter) S.F. Blake), tall wormwood (*Artemisia campestris* L. subsp. *caudata* (Michx.) H.M. Hall & Clem.), ground-cherries (*Physalis* spp.), sheep sorrel (*Rumex acetosella* L.), common mullein (*Verbascum thapsus* L.), horseweed (*Conyza canadensis* (L.) Cronq. var. *canadensis*), fleabane (*Erigeron strigosus* Willd.), and clones of *Carex pensylvanica*. In a small, disappearing sandy blow-out jointweed (*Polygonella articulata* (L.) Meissn.), pinweed (*Lechea intermedia* Britton var. *intermedia*), carpetweed (*Mollugo verticillata* L.), wartweed (*Chamaesyce glyptosperma* (Engelm.) Small), panic grasses (*Panicum* spp.), and *Cyperus houghtonii* (Torr.) all occur; hair-cap moss (*Polytrichum piliferum* Hedw.) is dominant.

On 22 May 1976, a mix of prairie seeds (purchased at the Weir Nature Center in Hales Corners, Wisconsin) was sprinkled on a small (about 5 × 5 m) plot in the sandy open South Fields. A few species began appeared from this planting starting in 1978 (Table 1). All native introduced prairie species were gone by 2000, with only the weedy common St. Johnswort (*Hypericum perforatum* L.) remaining and spreading in 2003. It should be stressed that there is no possibility that any of the other species of prairie affinity listed in this flora were introduced during this planting. The possibility is not excluded, however, that species such as little bluestem may have been introduced inadvertently during the pine planting operations in 1956.

Weeds and "fugitive" species. Weeds are dynamic plant species, for example, three-seeded mercury (*Acalypha rhomboidea* Raf.), was perhaps introduced in the red pine-planting operations in 1957 and persisted until about 1980. Drive-way weeds which have disappeared since 1980 include mock-pennyroyal (*Hedeoma hispida* Pursh), stickseed (*Lappula squarrosa* (Retz.) Dumort.), and

chicory (*Cichorium intybus* L.). In the late 1970's a few individuals of the rare "fugitive" native adder's-tongue fern (*Ophioglossum pusillum* Raf.), growing with rattlesnake fern and the orchid Loesel's twayblade (*Liparis loeselii* (L.) Rich.), were found growing among thick grass on the south side of the driveway opposite to where the garage now stands. The gravelly south side of the town road which forms the tract's northern boundary has many weeds (often transient) found nowhere else on the property.

DISCUSSION

Butternut Pines has a rich flora for a tract of its size. For example, Madeline Island in the Apostle Island archipelago is 370 times larger (14,800 acres) but has just a few more species (534; (Judziewicz & Koch 1993) than the tract (525 species)—and all other islands in the Apostles, even 10,054-acre Stockton Island (429 species), have much smaller floras. The main reason for the floristic richness of the tract is, I believe, the great diversity of habitats associated with the Oconto River. Using Curtis' (1961) vegetational classification scheme, one could argue that the following communities are present at Butternut Pines: alder thicket, bracken grassland, emergent aquatic, northern dry forest, northern dry-mesic forest, northern mesic forest, northern wet-mesic forest, pine barrens, sand prairie, southern sedge meadow (approaching northern sedge meadow and even calcareous fen in places), southern wet forest (floodplain forest), and submersed aquatics.

The tract has several noteworthy range extensions, mostly for southern floodplain species such as cottonwood and wild garlic. About 30 species are at or near their northern range limits at Butternut Pines, (Table 1), and several other southern species such as green dragon and bladdernut almost reach the boundaries of the tract. The most disjunct species is a population of purple twayblade, here isolated from the nearest known populations (to the south) by about 100 miles. Six species are at or near their southern range limits, and two are near their western range limits.

The following four vascular plant species are listed as "special concern" by the Wisconsin Department of Natural Resources and occur (or once occurred) on the tract: Missouri rock cress (*Arabis missouriensis* Greene), adder's-tongue fern, Hooker's orchid, and butternut. The first three were observed or collected as a few or single individuals in the late 1970s and have not been seen in the 1990s; they probably represented transient populations.

Some common species were not found on the tract, such as fireweed (*Epilobium angustifolium* L.), cow parsnip (*Heracleum lanatum* Michaux), bastard-toadflax (*Comandra umbellata* (L.) Nutt.), wooly blue violet (*Viola sororia* Willd.) and (as a native plant) pink lady's-slipper (*Cypripedium acaule* Aiton). This is not particularly surprising since "Butternut Pines" is essentially a huge sampling plot, and chance dictates that even some very common species will be absent.

TABLE 1. Species at their Range Limits on the Tract

Near their northern range limits:

Ground-nut (*Apios americana*)
 Grove sandwort (*Arenaria lateriflora*)
 Butterfly-weed (*Asclepias tuberosa* subsp. *interior*)
 Whorled milkweed (*Asclepias verticillata*)
 Ear-leaved brome (*Bromus altissimus*)
 Spring cress (*Cardamine bulbosa*)
 A sedge (*Carex brevior*)
 Silky dogwood (*Cornus amomum* var. *schuetzeana*)
 Dodder (*Cuscuta gronovii*)
 Wild yam (*Dioscorea villosa*)
 Beggar's-lice (*Hackelia virginiana*)
 Marsh vetchling (*Lathyrus palustris*)
 Cardinal flower (*Lobelia cardinalis*)
 Great blue lobelia (*Lobelia siphilitica*)
 Canada moonseed (*Menispermum canadense*)
 False dragonhead (*Physostegia virginiana*)
 Prickly-ash (*Zanthoxylum americanum*)

At their northern range limits:

Wild garlic (*Allium canadense* var. *canadense*)
 False nettle (*Boehmeria cylindrica*)
 Creeping love grass (*Eragrostis hypnoides*)
 Purple love grass (*Eragrostis spectabilis*)
 Wild madder (*Galium obtusum*)
 Wild geranium (*Geranium maculatum*)
 Greene's rush (*Juncus greenei*)
 White grass (*Leersia virginica*)
 Lesser clearweed (*Pilea fontana*)
 Cottonwood (*Populus deltoides* subsp. *monilifera*)
 Carrion flower (*Smilax herbacea* var. *lasioneura*)

"Beyond" their northern range limits (disjunct from farther south):

Downy hawthorn (*Crataegus mollis*) (north from Brown County)
 Purple twayblade (*Liparis lilifolia*) (northernmost state collection; otherwise known from Eau Claire and Green Lake counties and south).

Near their southern range limits:

A sedge (*Carex deflexa* var. *deflexa*)
 A sedge (*Carex ormostachya*)
 Spurred-gentian (*Halenia deflexa*)
 One-flowered pyrola (*Moneses uniflora*)
 A grass (*Puccinellia pallida*)
 Green-flowered pyrola (*Pyrola chlorantha*)

Near their western range limits:

Beech (*Fagus grandifolia*)
 Rough goldenrod (*Solidago patula* var. *patula*)

CHANGES IN THE FLORA, 1975–2004

The vegetation of the tract has changed considerably during the 30 seasons in which I have observed it in detail. In 1975, Butternut Pines was at an earlier stage of recovery from past logging and agricultural episodes, and there was much more “open” (non-forested) ground. This was especially true along the north (south-facing) riverbanks, which had glorious fenlike meadow margins with a display of colorful mid-summer forbs such as cardinal flower, great blue lobelia, purple-fringed orchid, Michigan lily, turtlehead, bottle gentian, and blue vervain. In 2003 these species are still present but in much smaller numbers and woody shrubs and tree saplings have essentially crowded the meadows out of existence.

Most striking has been the loss of all 12 aquatic macrophytes in the river in the last quarter-century. There are several possible causes: the increased turbidity and/or pollution of the river (the rich mollusk fauna of the 1960s is gone) by chemicals used to control lawn weeds; herbivory by exotic aquatic invertebrates; and shading by regrowth of the forest on the south bank. It has also apparently affected the riverside mudflat flora, which is much more depauperate then it was in the late 1970s.

The “Slough,” the ancient abandoned river channel with a rich mosaic of alder thicket, hardwood ash and elm forest, and emergent aquatic communities, has also become more depauperate floristically, again I think because of increased shade.

The tree flora has taken two big hits in the past 30 years. First, large American elms along the river and even in some upland areas died off in the late 1960s through the 1970s. Standing dead trees could be seen even into the 1990s but are now all fallen. And, starting in the 1990s, butternuts (Fig. 1) have succumbed to a canker disease. There are still living trees in 2004, but they can’t survive too many more years. Until trapped-out in 1996, beavers infested the river in the mid-1990s and ravaged pole-sized stands of hardwood trees, especially white and yellow birch, basswood, and green ash.

Other tree species have flourished and increased since 1975. There is abundant red oak and white pine regeneration around the cabin and elsewhere on the tract. And, in the remnant Scotch pine plantation across the river (planted in a hay field in 1956), hemlock regeneration has “gone wild” in the past decade, with abundant and luxuriant seedling and sapling recruitment in the 1990s. This increase has occurred despite a large local white-tailed deer population (abetted by locals who feed them year-round). There is even a bit of white cedar regeneration in this pine plantation.

Has climate change been a factor in floristic change here? Perhaps. Two northern species appear to have been naturally extirpated from the tract over the past two decades, namely mountain maple, known from a shaded, north-facing riverbank; and twinflower, from woods west of the cabin. However, these “drop-outs” could be natural stochastic events since the populations of these two species were small to begin with.

Plant and animal interactions are often intertwined, and the following (admit-

tedly anecdotal) observations on faunistic changes in the tract since the 1960s may have some bearing on explaining floristic changes that have occurred there. There have been large decreases in the following animal groups in the past 40 years here: fresh-water mollusks in the river (especially the Wabash pigtoe (*Fusconaia flava*), which was dominant); water-striders; dragonflies; frogs; moths, and butterflies. Increases have included deer, turkeys (first seen in 1995 and now abundant), fishers, and opossums. Deer appear to have negatively affected some species such as corn-lily and Canada mayflower by excessive browse, but help others such as beggar's-lice and burdock because these species are spread as "stick-tights" in their fur.

CHECKLIST OF VASCULAR PLANTS

The names follow the recent checklist of the plants of Wisconsin (Wetter et al. 2001), while the families follow the classic Engler & Prantl arrangement within the large groups Pteridophytes, Gymnosperms, Monocotyledons, and Dicotyledons. Common names follow Peterson & McKenny (1968) as well as the Wetter et al. checklist. Within families and genera, genera and species are arranged alphabetically. An asterisk (*) denotes species introduced to the Oconto County region.

The following list includes 95 families, 284 genera, and 525 species of vascular plants; 76 (15%) are alien. There are 33 species of pteridophytes, 9 conifers, 151 monocots, and 332 dicots. The largest families are the Asteraceae (56 species), Cyperaceae (48), Poaceae (48), and Rosaceae (33); *Carex* (40 species) is the largest genus. Table 2 gives a list of excluded species—the very few plants that I have purposely introduced to the tract.

TABLE 2. Listed of Excluded Species (those intentionally introduced and not spreading).

Cypripedium acaule Aiton, pink lady's-slipper (Orchidaceae). In 1977, six plants were salvaged from a pine plantation (a few miles away) about to be cut and transplanted to acid sandy ground under white pines near the cabin. Four plants survived for many years, blooming most years, but declining in the late-1980's; one survived until 1991. No plants have been noted after that year.

Diarrhena obovata (Gleason) Brandenb., obovate beak grain (Poaceae). One clump from Iowa was transplanted to a shaded, mesic site (under basswoods) by the river in May 1996. It has vigorously thrived and flowered every year through 2003.

Festuca saximontana Rydb. subsp. *saximontana* (Poaceae), Rocky Mountain fescue. Two clumps well-established near cabin door in 1993 and not seen since. 10182. Doubtlessly this species was introduced via hiking boots or waste plant collection material from the Apostle Islands in 1991-1992.

Hieracium longipilum Hook., hairy hawkweed. Collected once in 1981 from the drier sandy parts of the South Fields, and not seen since. It could have appeared from the 1976 prairie plantings. 2320.

Liatris pycnostachya Michx., prairie blazing-star (Asteraceae). Introduced as seed in 1976; see note under *Ratibida pinnata*. First noted blooming on 25 August 1980, and still present on 29 August 1993 (10780). Not noted after 1999.

Ratibida pinnata (Vent.) Barnh., gray-headed coneflower (Asteraceae). This was a remnant of prairie seed mix planted in the South Field in 1976. It was first noted here in June 1978, and one or two individuals (10059) or their offspring were observed through 29 August 1993. Not noted after 1999.

PTERIDOPHYTES

LYCOPODIACEAE (Clubmoss Family)

- Diphasiastrum complanatum* (L.) Holub, northern running-pine. Rare, near cabin, 19 Oct. 2002. 14751 (UWSP).
D. digitatum (A. Braun) Holub, crowfoot clubmoss. Common, woodlands. 173, 942, 10032.
Huperzia lucidula (Michx.) Trevis, shining clubmoss. Rare, woods. 572.
Lycopodium annotinum L., stiff clubmoss. Rare, woods near sauna. 9998.
L. clavatum L., running clubmoss. Occasional, forest edges such as west of cabin. 949.
L. dendroideum Michx., round-branched ground-pine. Occasional, forest edges such as west of cabin and by the garage. 940.
L. hickeyi W.H. Wagner, Beitel & R.C. Moran, Hickey's clubmoss. Just south of Slough and west of driveway, 29 Sept. 2002, 14750 (UWSP).

EQUISETACEAE (Horsetail Family)

- Equisetum arvense* L., field horsetail. Common, ditches and wet edges. 195.
E. hyemale L. subsp. *affine* (Engelm.) Calder & Roy L. Taylor, common scouring-rush. Common, forming dense thickets at east end of Slough. 1095, 1158.
E. pratense Ehrh., meadow horsetail. Rare, East Shelf woods. 190, 10179.
E. scirpoides Michx., dwarf scouring-rush. Fairly common, shaded riversides, Slough edge, and steep slopes. 189.
E. sylvaticum L., woodland horsetail. Local, under dead elms in western Slough. 624.

OPHIOGLOSSACEAE (Adder's-tongue Family)

- Botrychium dissectum* Spreng., dissected grape-fern. Occasional, fields. 5, 10781.
B. matricariifolium (Döll) W.D.J. Koch, daisy-leaved grape-fern. Uncommon, edges. 2, 3, 1083.
B. multifidum (S.G. Gmel.) Rupr., leathery-leaved grape-fern. Fairly common, South Fields. 864, 10027, 10053.
B. virginianum (L.) Sw., rattlesnake fern. Common, woods and edges. 737, 881.
Ophioglossum pusillum Raf., adder's-tongue. Rare, moist grassy side of driveway near garage, with *Liparis loeselii* and *Botrychium matricariifolium*. 438. Seen here only from 1978–1982. SPECIAL CONCERN, Wisconsin DNR.

OSMUNDACEAE (Flowering fern Family)

- Osmunda cinnamomea* L., cinnamon fern. Common, Slough edges and riversides. 10006.
O. claytoniana L., interrupted fern. Occasional, Slough edge, Hawthorn Glen. 10005.
O. regalis L. var. *spectabilis* (Willd.) A. Gray, royal fern. Occasional, Slough margin and at Hawthorn Glen. 862.

DENNSTAEDTIACEAE (Bracken Family)

- Pteridium aquilinum* (L.) Kuhn var. *latiusculum* (Desv.) A. Heller, bracken fern. Common, woods. 1161.

PTERIDACEAE (Maidenhair Fern Family)

- Adiantum pedatum* L., maidenhair fern. Fairly common, woods. 843.

DRYOPTERIDACEAE (Wood Fern Family)

- Athyrium filix-femina* (L.) Mert. var. *angustum* (Willd.) G. Lawson, lady fern. Common, woods. 1170, 10017.
Cystopteris tenuis (Michx.) Desv., MacKay's brittle fern. Local, overhanging riverbanks on East and West Shelves. 781, 10040.
Dryopteris carthusiana (Vill.) H.P. Fuchs, spinulose wood fern. Common. woods. 1160, 10783.
D. cristata (L.) A. Gray, crested wood fern. Common, Slough; uncommon near river. 394, 948.
D. intermedia (Muhl.) A. Gray, glandular wood fern. Woods near cabin. 1160.
Gymnocarpium dryopteris (L.) Newman, oak fern. Occasional along western Slough and on north-facing riverbanks. 1159.
Matteuccia struthiopteris (L.) Todaro var. *pennsylvanica* (Willd.) C.V. Morton, ostrich fern. Common, riverside woods, especially on south bank. 926.

Onoclea sensibilis L., sensitive fern. Common, riversides, eastern Slough, and ditches. 898.

POLYPODIACEAE (Polypody Family)

Polypodium virginianum L., polypody fern (Fig. 3). Local, steep shaded riverbanks; apparently increasing from 1975–2000. 404.

THELYPTERIDACEAE (Marsh Fern Family)

Phegopteris connectilis (Michx.) Watt, narrow beech fern. Rare; a single colony at Hawthorn Glen (1975–2001; increasing from 15 fronds in 1975 to 65–70 fronds in 2003). 779.

Thelypteris palustris Schott var. *pubescens* (Lawson) Fernald, marsh fern. Common in Slough; occasional along river. 863.

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)

Thuja occidentalis L., white cedar. Common, north-facing riverbank; occasional elsewhere. 1157.

PINACEAE (Pine Family)

Abies balsamea (L.) Mill., balsam-fir. Occasional small tree. 1146.

Larix laricina (Du Roi) Koch, tamarack. Rare; one sapling at NE corner of Scotch pine plantation. 700.

Picea glauca (Moench) Voss, white spruce. Rare; one tree at the West Shelf. 720.

Pinus banksiana Lambert, jack pine. Common, South Fields; aggressively spreading from a 1950s plantation on an adjacent property (Fig. 5). 10029.

P. resinosa Aiton, red pine. Plantation along road; a few spontaneous trees in the South Field. 10036.

P. strobus L., white pine. Dominant tree. 1142.

**P. sylvestris* L., scotch pine. Plantation in SW corner; aggressively spreading east into the South Fields. 10028.

Tsuga canadensis (L.) Carrière, hemlock. Fairly common, north-facing slopes and banks. 10057.

MONOCOTYLEDONS

TYPHACEAE (Cat-tail Family)

Typha latifolia L., common cat-tail. In Slough on west side of driveway crossing; common in 1970s and 1980s, uncommon by 2000 because of increasing shade.

SPARGANIACEAE (Bur-reed Family)

Sparganium emersum Rehmann, narrow-leaved bur-reed. Occasional, riverside mud. 215.

POTAMOGETONACEAE (Pondweed Family)

Potamogeton gramineus L. or *P. illinoensis* Morong. Sight records from the river in the late 1970s.

Potamogeton nodosus Poir. There were several large beds in the river from the 1960s on, but it was last seen in 1992. 54, 129, 196, 2396, 10049.

P. richardsonii (Ar. Bennett) Rydb. For many years a large colony in river off Hawthorn Glen; gone by 1992. 110B.

Stuckenia pectinata (L.) Börner, sago pondweed. Formerly (1970s and 1980s) near Ironwood Rapids, now gone. 536, 818, 1022.

ALISMATACEAE (Water-plantain Family)

Alisma triviale Pursh, water-plantain. Rare, riverside mud. 409.

Sagittaria latifolia Willd. var. *latifolia*, arrowhead. Common, riverside mud. 10016.

HYDROCHARITACEAE (Frog's-bit Family)

Elodea canadensis Michx., waterweed. Fairly common in river in 1970s and 1980s; gone by late 1990s.

Vallisneria americana Michx., wild-celery. Fairly common in river in 1970s; gone by late 1990s. 844.

POACEAE (Grass Family)

- **Agrostis gigantea* Roth, redtop. Common, fields. 191, 238.
A. hyemalis (Walter) Britton, Stearns, & Poggenb. var. *scabra* (Willd.) Blomq., tickle grass. Locally common, dry parts of South Fields. 65, 186.
A. perennans (Walter) Tuckerman var. *perennans*, upland bent. Central Slough. 161.
**Avena sativa* L., oats. Rare weed, the town road. 400.
Brachyelytrum erectum (Schreber) P. Beauv., slender wedge grass. Local, East Shelf woods and Leaning Pine. 52, 10058.
Bromus altissimus Pursh, ear-leaved brome. Rare along river. 417, 1011. Near the species' northern range limit.
B. ciliatus L., fringed brome. Common, riverside meadows. 1010.
**B. inermis* Leyss., smooth brome. Common, the town road; occasional, South Fields. 106.
Calamagrostis canadensis (Michx.) P. Beauv. var. *canadensis*, bluejoint. Local, only in Slough west of driveway. 446.
Cinna arundinacea L., wood-reed. Rare, north side of river at NE corner. 411, 910.
C. latifolia (Göpp.) Griseb., wood-reed. Rare, rich woods on East Shelf. 872.
Danthonia spicata (L.) Roem. & Schult., poverty oat-grass. Common, fields. 55.
Digitaria cognata (Schult.) Pilg. var. *cognata*, fall witch grass. Found from 1978 along nearby Nauke Road, but first collected on the tract on 14 Sept. 2002, where it had spread along the fence in the northwest corner, 14746, UWSP.
**D. ischaemum* (Schweigg.) Muhl., crabgrass. Occasional weed, driveway and road. 174, 912.
Echinochloa muricata (P. Beauv.) Fernald, barnyard grass. Rare, riverside mud. 10047.
Elymus hystrix L., bottlebrush grass. Rare in seeps at east end of Slough. 811.
E. virginicus L. var. *virginicus*, Virginia wild-rye. Common, riverside. 101.
**Elytrigia repens* (L.) B.D. Jacks., quack grass. Common, fields. 857.
**Eragrostis cilianensis* (All.) Janch., stink grass. Rare weed, the town road. 379.
E. hypnoides (Lam.) Britton, Stearns & Poggenb., creeping love grass. Occasional, riverside mud. 102. At the species' northern range limit.
**E. pectinacea* (Michx.) Nees var. *pectinacea*, love grass. Occasional weed, driveway and the town road. 175.
E. spectabilis (Pursh) Steud., purple love grass. Locally common, dry parts of South Fields. 169, 875. At the species' northern range limit.
**Festuca pratensis* Huds., meadow fescue. Rare, driveway near cabin. 2140.
F. subverticillata (Pers.) E.B. Alexeev, nodding fescue. Rare, rich woods, East Shelf. 82, 293.
Glyceria grandis S. Watson, tall manna-grass. In 1970s, local, central Slough; in 1990s–2001, common on riverside mud.
G. striata (Lam.) Hitchc., fowl manna-grass. Common along Slough and river. 63, 593.
**Hordeum jubatum* L., squirrel-tail barley. Weed along the town road, seen in 1975 and not since.
Leersia oryzoides (L.) Sw., rice cut-grass. Common along river and central Slough. 930.
L. virginica Willd., white grass. Rare, riverbank mud at East Shelf. 871. At the species' northern range limit.
Muhlenbergia glomerata (Willd.) Trin., wild marsh-timothy. Rare, central and eastern Slough margins. 419, 422.
M. mexicana (L.) Trin., muhly-grass. Occasional, fields. 177, 12461.
Oryzopsis asperifolia Michx., rice-grass. Fairly common, dryish pine woods such as west of the cabin. 648.
O. pungens (Spreng.) Hitchc. Rare and local among on west side of cabin. 649.
Panicum acuminatum Sw. var. *fasciculatum* (Torr.) Lelong. Occasional, fields. 23, 57, 143, 458, 588, 745, 1065, 1102.
P. capillare L., witch grass. Occasional, the town road, driveway, and sand blow-out. 178, 529, 12457.
P. columbianum Scribn. Uncommon, the town road and sand blow-out. 56, 476.
P. depauperatum Muhl. Occasional, fields and roadsides. 53, 76, 571, 598, 1064, 1085.
**Pennisetum glaucum* (L.) R. Br., pearl millet or yellow foxtail. Occasional, roadsides and South Fields. 162.

- **Phleum pratense* L., timothy. Common, fields and roadsides. 856.
 **Poa annua* L., annual bluegrass. Occasional, driveway. 10010. Blooming as late as 3 December 1999.
 **P. compressa* L., Canada bluegrass. Common, fields and dry banks. 879.
P. palustris L., fowl meadow-grass. Occasional, riverside meadows. 468, 589, 10310.
 **P. pratensis* L., Kentucky bluegrass. Abundant, fields. 61, 220, 601, 724.
Puccinellia pallida (Torr.) R.T. Clausen. Uncommon in riverside mud. 408. At the species' southern range limit.
Schizachne purpurascens (Torr.) Swallen, false melic. Fairly common, edges of pine woods. 44.
Schizachyrium scoparium (Michx.) Nash, little bluestem. Dominant in SW corner of South Fields. 176.
Sphenopholis intermedia (Rydb.) Rydb., slender wedge grass. Occasional, north riverbanks. 242, 388, 835, 2551.
Sporobolus vaginiflorus (A. Gray) A.W. Wood, sheathed dropseed. Locally common on 3 Sept. 2001 along pavement of town road in NW corner of tract (14479, UWSP); not noted in previous years.

CYPERACEAE (Sedge Family)

- Carex arctata* Hook. Common, woods and edges. 38, 619, 10167.
C. aurea Nutt. Fairly common, edges and riversides. 448, 569, 592, 755, 1088.
C. bebbii (L. Bailey) Fernald. Fairly common, riverside meadows. 289, 1007.
C. brevior (Dewey) Lunnell. Rare, dry sandy fields near Ice Ponds. 222. Near the species' northern range limit.
C. bromoides Willd. subsp. *bromoides*. Locally common, springy east end of Slough. 10. 1092.
C. brunnescens (Pers.) Poir. subsp. *sphaerostachya* (Tuck.) Kalela. Uncommon, moist woods. 662, 1103.
C. canescens L. Local, central Slough alder thicket. 665.
C. castanea Wahlenb. Occasional, moist edges and woodlands. 21, 604, 741, 1151.
C. cephaloidea (Dewey) Dewey. Rare, rich mesic riverbank woods on south bank opposite cabin. 527.
C. communis L. var. *communis* Bailey. Common, woods with pines. 591, 663.
C. crawfordii Fernald. Rare, seeps at east end of Slough. 134.
C. cristatella Britton. Rare, central Slough. 244, 1003, 10044.
C. debilis Michx. var. *rudgei* L.H. Bailey. Local, woods east of Hawthorn Glen, and along central Slough. 574.
C. deflexa Hornem. var. *deflexa*. Rare, along Slough west of driveway. 625. Also in 2002 among jack pines in south field, 14516, UWSP. Near the species' southern range limit.
C. deweyana Schwein. subsp. *deweyana*. Common, fields and edges. 568, 10200.
C. disperma Dewey. Rare, wet woods at Hawthorn Glen and western Slough. 600.
C. gracillima Schwein. Abundant, woods and edges. 15, 618, 10188.
C. granularis Willd. Common, riverside meadows. 237, 626, 667, 681, 1093.
C. gynandra Schwein. Locally common, riverside meadows (Hawthorn Glen, Ironwood Rapids swale, east end of Slough). 33.
C. hirtifolia Mack. Rare, rich riverside deciduous woods; first noted in 2000. 14143.
C. hystericina Willd. Fairly common, riverside mud and meadows, especially in eastern part. 74, 108.
C. interior L.H. Bailey Common, riversides and east end of Slough. 20, 59.
C. intumescens Rudge. Common, riverside meadows; occasional, Slough and old fields. 66.
C. leptalea Wahlenb. subsp. *leptalea*. Locally common, east end of Slough. 60, 1098.
C. leptoneuria (Fernald) Fernald. Fairly common, woods and edges. 528, 622, 664, 1100.
C. lupulina Willd. Uncommon, central and east end of Slough, and Hawthorn Glen. 1004.
C. ormostachya Wiegand. Local, moist pine woods near cabin. 19, 602, 585, 586. Near the species' southern and western range limits.
C. peckii Howe. Local, dry bank near cabin. 77.
C. pedunculata Willd. Fairly common, upland woods, especially with pines. 25, 647, 1176.
C. pensylvanica Lam. Common, woods and fields. 1082, 10171.

- C. projecta* Mack. Fairly common, riverside meadows. 83, 290.
C. radiata (Wahlenb.) Small. Fairly common near river. 623, 1974, 4700.
C. retrorsa Schwein. Common, Slough; also Hawthorn Glen. 107, 210, 836, 10015.
C. scoparia Willd. Occasional, swales in old fields. 170, 223, 1001, 1002.
C. stipata Willd. Common, central Slough; uncommon along the river. 67.
C. stricta Lam. Locally common, north side riverbanks, West Shelf and Ironwood Rapids. 1099.
C. tenera Dewey var. *tenera*. Rare, swales along Slough and Ironwood Rapids. 218, 241, 291, 292, 296, 526, 1008.
C. tonsa (Fernald) E.P. Bicknell var. *tonsa*. Fairly common, dry old fields. 660, 1179.
C. tuckermanii Dewey. Uncommon, central and eastern Slough. 10001.
C. vesicaria L. Rare, central Slough. 10050.
Cyperus houghtonii Torr. Local, in sand blow-out. 407.
Eleocharis acicularis (L.) Roem. & Schult., needle spike-rush. Mats seen in riverbank mud in August 1977, but not since.
Eleocharis erythropoda Steud., spikerush. Rare, riverside mud at Hawthorn Glen. 192.
E. intermedia (Muhl.) Schult., matted spike-rush. Occasional, riverside mud. 109.
Schoenoplectus tabernaemontani (C.C. Gmel.) Palla, softstem bulrush. Rare, east-central Slough. 12465.
Scirpus atrovirens Willd. Occasional, riversides. 75, 10019.
S. cyperinus (L.) Kunth, wool-grass. Uncommon, riversides.
S. microcarpus C. Presl. Rare, seeps at east end of Slough. 2142.

ARACEAE (Arum Family)

- Arisaema triphyllum* (L.) Schott var. *triphyllum*, jack-in-the-pulpit. Occasional, riverbank woods, especially on East Shelf. 733, 1096.
Calla palustris L., calla-lily. Local, central Slough. 794.
Symplocarpus foetidus (L.) Nutt., skunk cabbage. Local, East Shelf woods and Hawthorn Glen. 1154, 10174.

LEMNACEAE (Duckweed Family)

- Lemna minor* L., common duckweed. Occasional, river; locally abundant in Slough on west side of driveway.
L. trisulca L., forked duckweed. Present in some years in Slough on west side of driveway. 814.
Spirodela polyrrhiza (L.) Schleid., greater duckweed. Seen in river near east border, 14 June 1977.

PONTEDERIACEAE (Pickerel-weed Family)

- Zosterella dubia* (Jacq.) Small, water star-grass. Occasional, riverside mud. 103, 127, 131, 298, 477, 1021. Gone by 2000.

JUNCACEAE (Rush Family)

- Juncus dudleyi* Wiegand. Local, springy east end of Slough. 14.
J. effusus L., common rush. Occasional, riverside meadows and in Slough. 769.
J. Greenei Oakes & Tuck., Greene's rush. Rare in dry "barrens" area in far southwest corner with jack pine, 1996. 12157, 12465. At the species' northern range limit.
J. nodosus L. var. *nodosus*. Occasional, riverside mud. 130.
J. tenuis Willd., path rush. Occasional along driveway and in South Fields. 64, 1025, 1026.
Luzula acuminata Raf. var. *acuminata*, wood-rush. Common, dry woods and edges. 29, 10103.
L. multiflora (Retz.) Lejeune subsp. *multiflora*. Rare, riverbank glade west of Hawthorn Glen and in young woods in South Fields. 831, 1120.

LILIACEAE (Lily Family)

- Allium canadense* L. var. *canadense*, wild garlic. Rare, riverbank in West Shelf woods. 590, 786. At the species' northern range limit.
A. tricoccum Aiton var. *tricoccum*, wild leek. Local; commonest in riverbank thicket at Ironwood Rapids. 1069, 1175.
 **Asparagus officinalis* L., asparagus. Occasional in ditches along The road. 691.

Clintonia borealis (Aiton) Raf., bluebead; corn-lily. Occasional, woods, especially near the Slough. 732, 10205.

Lilium michiganense Farw., turk's-cap lily. Occasional, riverside meadows. 770.

Maianthemum canadense Desf., Canada mayflower. Common, woods. 1119, 10202.

Polygonatum pubescens (Willd.) Pursh, Solomon's-seal. Occasional, woods. 731, 10176.

Smilacina racemosa (L.) Desf. var. *racemosa*, false Solomon's-seal. Fairly common, woods. 883.

S. stellata (L.) Desf., starry false Solomon's-seal. Local, steep dry bank at Leaning Pine. 621.

Streptopus roseus Michx., var. *longipes* (Fernald) Fassett, rosy twisted-stalk. Occasional, rich riverside woods. 730.

Trillium cernuum L., nodding trillium. Scattered in woods along river and Slough. 1129, 10175.

T. grandiflorum (Michx.) Salisb., great white trillium. Common, young woods. 699, 709, 10186.

Uvularia grandiflora Sm., large-flowered bellwort. Uncommon, rich woods on East Shelf and at east end of Slough. 708, 10177.

SMILACEAE (Cat-brier Family)

Smilax ecirrhata (Kunth) S. Watson, upright carrion flower. Local, riversides in eastern part (East Shelf). 722, 1101. At the species' northern range limit.

S. herbacea L. var. *lasioneura* (Hook.) A.DC., carrion flower. Occasional, riversides. 719.

S. hispida Torr., bristly greenbrier. Occasional, riversides (East Shelf). 718.

DIOSCOREACEAE (Yam Family)

Dioscorea villosa L., wild yam. Occasional, riverbank woods. 714, 2405. Near the species' northern range limit.

IRIDACEAE (Iris Family)

Iris versicolor L., northern blue flag. Common along river. 753.

Sisyrinchium montanum Greene, blue-eyed grass. Rare, hill in middle of South Fields in 1978, 1124. Not seen again until a single flowering plant was collected along Logan Road on 23 July 2003.

ORCHIDACEAE (Orchid Family)

Corallorhiza trifida Châtel., early coral-root. Uncommon on steep, north-facing coniferous river-banks; also in red pine plantation. 567.

Goodyera pubescens (Willd.) R. Br., downy rattlesnake-plantain. Rare, Scotch pine plantation. 472.

G. repens (L.) R. Br. var. *ophioides* Fernald, creeping rattlesnake-plantain. Rare, Scotch pine plantation. 464, 2198.

Liparis lilifolia (L.) Lindl., purple twayblade. Rare, in riverbank woods east of Hawthorn Glen; also in Scotch pine plantation. 525, 819. Disjunct north from the main portion of the species' range.

L. loeselii (L.) Rich., Loesel's twayblade. Occasional, moist ditches and swales. 787, 897, 2325.

Malaxis unifolia Michx., green adder's-mouth. Uncommon, aspen woods near garage, and in moss mats in Scotch and jack pine plantations south of river. 463, 2321.

Platanthera hookeri (A. Gray) Lindl., Hooker's orchid. Rare, a single plant in Scotch pine plantation followed from 1978-1981; it bloomed in alternate years. 2414. Listed as SPECIAL CONCERN by Wisconsin DNR.

P. huronensis (Nutt.) Lindl., tall northern bog orchid. Occasional, riversides, especially on more shaded south bank. 445.

P. psycodes (L.) Lindl., purple fringed orchid. Occasional, riverbank meadows. 302.

Spiranthes casei Catling & Cruise, Case's lady's-tresses. Occasional, swales in the South Fields. 4702.

S. cernua (L.) Rich., nodding ladies'-tresses. Rare, seep at Carex Springs. 368.

S. lacera (Raf.) Raf., slender ladies'-tresses. Rare, a colony in the Scotch pine plantation. 455, 2322. Not noted after plantation was thinned in 1982, even though the immediate area of the colony was not cut.

DICOTYLEDONS

SALICACEAE (Willow Family)

- Populus balsamifera* L. subsp. *balsamifera*, balsam-poplar. Common along river, occasional on uplands. 953.
P. deltoides Marshall subsp. *monilifera* (Aiton) Eckenw., cottonwood. A single large tree on riverbank by cabin. At the species' northern range limit. 968.
P. grandidentata Michx., bigtooth aspen. Common. 944.
P. tremuloides Michx., quaking aspen. Common. 946.
Salix amygdaloides Andersson, peachleaf willow. A single large tree on south bank of river near cabin. 630. It died in 1992.
S. discolor Muhl., pussy willow. Common, Slough; occasional near rivers.
S. humilis Marshall, prairie willow. Uncommon, ditch along The road. 706.
S. lucida Muhl. subsp. *lucida*, shining willow. Locally common, central Slough. 1063.
S. petiolaris Sm., slender willow. Common, South Fields; occasional along Slough and river. 952.

MYRICACEAE (Bayberry Family)

- Comptonia peregrina* (L.) Coulter, sweet-fern. Common, dry parts of old fields. 899.

JUGLANDACEAE (Walnut Family)

- Juglans cinerea* L., butternut. Common, woods, especially near cabin. 900, 2411. The large tree just across the driveway south of the garage was a local landmark, and the tract takes part of its name from this individual. Several older local residents recalled that during the 1930's "it was the only tree on your property" (surely an exaggeration) and that "bushels" of nuts were gathered from it. It last bore nuts in 1993, and by 2004 was very near death due to the canker.

BETULACEAE (Birch Family)

- Alnus incana* (L.) Moench subsp. *rugosa* (Du Roi) R.T. Clausen, speckled alder. Dominant in Slough; common along river. 956, 1729.
Betula alleghaniensis Britton, yellow birch. Occasional, rich woods along the river.
B. papyrifera Marshall, white birch. Dominant tree. 1156, 10055.
Carpinus caroliniana Walter, ironwood. Common, thicket-forming small tree near the river. 938, 1779.
Corylus americana Walter, American hazelnut. Uncommon, woods near cabin. 934.
C. cornuta Marshall subsp. *cornuta*, beaked hazelnut. Common, woods. 933.
Ostrya virginiana (Miller) K. Koch, hop-hornbeam. Rare; one pole-sized tree on riverbank west of Hawthorn Glen. 939.

FAGACEAE (Beech Family)

- Fagus grandifolia* Ehrh., beech. Occasional as a sapling. Once one of the dominant forest trees on the tract, according to pre-settlement vegetation notes. 937, 1858. Near the species' western range limit.
*Quercus ellipsoidal*s E.J. Hill, Hill's oak. Rare, a few saplings in drier parts of the South Fields. 747.
Q. macrocarpa Michx. var. *macrocarpa*, bur oak. Rare, a few saplings in NE corner of South Fields, seedlings elsewhere. 771.
Q. rubra L., red oak. Common, woods. 746.

ULMACEAE (Elm Family)

- Ulmus americana* L., American elm. Large trees along river and woods all dead by early 1970's; a few small trees surviving, as near the garage. 752, 959.

MORACEAE (Mulberry Family)

- Humulus lupulus* L. var. *lupuloides* E. Small, hops. Rare, a single plant climbing in riverbank thicket east of Ironwood Rapids. 715, 2397, 10197.

URTICACEAE (Nettle Family)

- Boehmeria cylindrica* (L.) Sw., false nettle. Occasional, riversides in western part, as at Hawthorn Glen. 878, 1017. At the species' northern range limit.

- Laportea canadensis* (L.) Wedd., wood nettle. Local; Hawthorn Glen and East Shelf. 894.
Pilea fontana (Lunnell) Rydb., lesser clearweed. Occasional, riverbank mud; also central Slough. 945. At the species' northern range limit.
Urtica dioica L. subsp. *gracilis* (Aiton) Selander, stinging nettle. Local, Hawthorn Glen. 10020.

ARISTOLOCHIACEAE (Birthwort Family)

- Asarum canadense* L., wild ginger. Locally common in rich woods, East Shelf, east end of Slough, and south bank opposite cabin. 1174, 10173.

POLYGONACEAE (Buckwheat Family)

- Polygonella articulata* (L.) Meissner, jointweed. Local, sand blow-out. 167.
 **Polygonum aviculare* L., common knotweed. Uncommon, The road gravel. 826, 10003.
P. cilinode Michx., fringed false buckwheat. Fairly common, old fields. 760.
 **P. convolvulus* L., black bindweed. Local, dry SW corner of South Fields. 457.
P. hydropiper L., water-pepper. Uncommon, central Slough and along river. 166.
 **P. persicaria* L., lady's-thumb. Occasional, riverside mud. 420, 456, 10042.
P. sagittatum L., tearthumb. Local, eastern Slough. 132.
 **Rumex acetosella* L., sheep sorrel. Common, drier parts of old fields. 759, 10180.
R. verticillatus L., swamp dock. Occasional, Hawthorn Glen and Slough. 10002.

CHENOPODIACEAE (Goosefoot Family)

- **Chenopodium album* L., lamb's-quarters. Uncommon, old fields and roadsides. 827, 12459.
C. simplex (Torr.) Raf., maple-leaved goosefoot. One plant seen just east of cabin in June 1977. Not seen again until 1995, when collected near outhouse. 11551, 12447.
 **Salsola tragus* L., Russian-thistle. A few plants in new gravel of driveway in 1994. Not persisting. 11190.

AMARANTHACEAE (Amaranth Family)

- **Amaranthus albus* L., tumbleweed. Rare, animal burrow in South Fields. 414.

MOLLUGINACEAE (Carpetweed Family)

- **Mollugo verticillata* L., carpetweed. Local, sand blow-out in 1975. Along Logan Road in 2002, 14735, UWSP.

PORTULACACEAE (Purslane Family)

- Claytonia virginica* L. var. *virginica*, Virginia spring-beauty. Occasional, open woods, especially on West Shelf. But not noted there in 2001. 710, 1163, 11202.
 **Portulaca oleracea* L., purslane. A weed along Logan Road, first collected 15 Aug. 2002, 14734 UWSP.

CARYOPHYLLACEAE (Pink Family)

- Arenaria lateriflora* L., grove sandwort. Local, rich woods on West Shelf; also at Ironwood Rapids. 620, 1109, 10204. Near the species' northern range limit.
 **Cerastium fontanum* Baumg. subsp. *vulgare* (Hartm.) Greuter & Burdet, mouse-ear chickweed. Occasional weed, fields and roadsides. 478, 744.
 **Silene latifolia* Poir. subsp. *alba* (Miller) Greuter & Burdet, white campion. Occasional, driveway and the road. 761.
 **S. vulgaris* (Moench) Garcke, bladder campion. Occasional along The road. 798.
Stellaria longifolia Willd., stitchwort. Uncommon, opening near garage and near Hawthorn Glen. 728.

CERATOPHYLLACEAE (Hornwort Family)

- Ceratophyllum demersum* L., coontail. Occasional in river. 208. Gone by 2000.

RANUNCULACEAE (Buttercup Family)

- Actaea rubra* (Aiton) Willd., red baneberry. Uncommon, woods; most frequent on East Shelf. 874.
Anemone americana (DC.) H. Hara, round-lobed hepatica. Occasional, woods north of river. 34, 10101.
A. canadensis L., Canada anemone. Locally common, riverside meadows. 1094.
A. cylindrica A. Gray, thimbleweed. 546, 777, 10008. Occasional, fields.

- A. quinquefolia* L. var. *quinquefolia*, wood anemone. Common, woods. 30, 10189.
Aquilegia canadensis L., columbine. Rare, riverbank at West Shelf. 729.
Caltha palustris L., marsh-marigold. Common, Slough. 707, 10104.
Clematis virginiana L., virgin's-bower. Scattered along The road and riverbanks. 832.
Coptis trifolia (L.) Salisb., goldthread. Occasional along central Slough; also shaded riverbank woods. 300, 713, 10203.
Ranunculus abortivus L., kidneyleaf buttercup. Occasional, woods edges north of river. 695, 1169, 10190.
 **R. acris* L., common buttercup. Weed in driveway, present from 1984 on (flowering 18 June 2003 by cabin). 10191.
R. aquatilis L. var. *diffusus* With., white water-crowfoot. Occasional, riverbank mud. 50, 216, 548.
R. hispidus Michx., swamp buttercup. Common, riverbank meadows. 1113.
R. pennsylvanicus L.f., bristly crowfoot. Occasional, riversides and central Slough. 193.
R. recurvatus Poir. var. *recurvatus*, hooked crowfoot. Occasional, riversides, swales, and Slough margins. 765, 10021, 10192.
Thalictrum dasycarpum Fisch. & Avé-Lall., late meadow-rue. Occasional, riversides. 941.
T. dioicum L., early meadow-rue. Fairly common, riversides. 1166, 10185.

BERBERIDACEAE (Barberry Family)

- Caulophyllum thalictroides* (L.) Michx., blue cohosh. Rare (5 plants, 1993), rich woods on East Shelf. 961, 10178.

MENISPERMACEAE (Moonseed Family)

- Menispermum canadense* L., Canada moonseed. Rare; one plant on West Shelf at west border fence. 751. Near the species' northern range limit.

PAPAVERACEAE (Poppy Family)

- Corydalis sempervirens* (L.) Pers., pale corydalis. Rare, disturbed ground near outhouse. 963.
 Noted only in 1976; the seeds could have been introduced on my boots following trips to the rock outcrops around Mountain, where the species is common.
Sanguinaria canadensis L., bloodroot. Local, rich riverside woods, East Shelf and Ironwood Rapids. 28, 1726, 10102.

BRASSICACEAE (Mustard Family)

- **Arabis glabra* (L.) Bernh., tower mustard. Occasional, South Fields. 822.
A. missouriensis Greene, northern rock cress. Rare, steep coniferous bank. 743. Noted only on 18 June 1978 in SE part of scotch pine plantation. Listed as SPECIAL CONCERN by Wisconsin DNR.
 **Barbarea vulgaris* R. Br., yellow rocket. Rare weed near cabin. 375.
 **Berteroa incana* (L.) DC., hoary alyssum. Common in dry ground along The road and driveway. 692.
 **Capsella bursa-pastoris* (L.) Medik., shepherd's-purse. Rare weed at cabin. 764.
Cardamine bulbosa (Muhl.) Britton, Stearns & Poggenb., spring cress. Local, a small colony in seep at east end of Slough; not seen after 1978 until 1994 and 1995, when several plants were found in the same location. 47, 11199. Near the species' northern range limit.
C. concatenata (Michx.) O. Schwarz, toothwort. Rare, rich woods at river's edge on south bank at west border. 1125.
C. diphylla (Michx.) A.W. Wood, toothwort. Common, rich riverbank woods. 658, 1718, 10164.
C. pennsylvanica Willd., bitter cress. Fairly common, riverbank mud and in central Slough. 105.
 **Lepidium densiflorum* Schrad., pepper-grass. Occasional weed along The road and driveway. 599.
Rorippa palustris (L.) Besser, yellow cress. Fairly common, riverbank mud. 443.
 **Sisymbrium altissimum* L., tumble-mustard. A few plants in new gravel of driveway in 1994. 11191.

SAXIFRAGACEAE (Saxifrage Family)

Chrysosplenium americanum Hook., golden saxifrage. Common, seeping meadow at Hawthorn Glen. 219, 1141.

Mitella diphylla L., bishop's-cap. Fairly common, rich riverside woods and along the central Slough. 659, 10164.5.

M. nuda L., naked miterwort. Local in woods along western Slough. 654, 10198.

Penthorum sedoides L., ditch-stonecrop. Uncommon, riverbank mud, especially on West Shelf. 449.

GROSSULARIACEAE (Gooseberry Family)

Ribes americanum Mill., wild black currant. Occasional along the Slough. 627, 657, 1722.

R. cynosbati L., pasture gooseberry. Occasional, woods and edges. 893.

R. triste Pall., swamp red currant. Local, central Slough; still present in 2002. 653.

HAMAMELIDACEAE (Witch-hazel Family)

Hamamelis virginiana L., witch-hazel. Locally common, dry bank tops east of cabin and heights along the road north of cabin. 931.

ROSACEAE (Rose Family)

Agrimonia gryposepala Wallr., agrimony. Uncommon, riverbanks at Hawthorn Glen and Ironwood Rapids. 809, 2418.

Amelanchier sp. 1884.

Amelanchier arborea (Michx. f.) Fernald, juneberry. Occasional, woods edges. 1143, 1167, 1884.

A. laevis Wiegand, smooth juneberry. Fairly common, mostly along riversides; can be a small tree. 1162, 1168.

A. spicata (Lam.) K. Koch. Occasional, riversides and South Fields. 629, 696, 705.

Aronia melanocarpa (Michx.) Elliott, chokeberry. Rare, central and east Slough. 721.

Crataegus mollis (Torr. & A. Gray) Scheele, downy hawthorn. Uncommon in pine woods near cabin. 392. Slightly disjunct north of the species' northern range limit.

C. punctata Jacq., dotted hawthorn. Locally common small tree near river and in South Fields; particularly common at Ironwood Rapids. 391, 2144.

Fragaria vesca L. subsp. *americana* (Porter) Staudt, wood strawberry. Occasional, fields. 1089.

F. virginiana Duchesne, wild strawberry. Occasional, fields and openings. 704, 960, 1775, 10193.

Geum aleppicum Jacq., yellow avens. Occasional, mostly near riverside meadows. 790.

G. canadense Jacq., white avens. Uncommon, Hawthorn Glen and west-central Slough. 824.

G. rivale L., water avens. Local, central Slough. 742.

Physocarpus opulifolius (L.) Maxim. Occasional, sunny riversides. 754, 11663 (Brule).

**Potentilla argentea* L., silvery cinquefoil. Occasional along driveway and The road. 303.

**P. norvegica* L., rough cinquefoil. Uncommon along driveway. 194, 807.

**P. recta* L., rough-fruited cinquefoil. Common, South Fields. 823, 10026.

**P. simplex* Michx., common cinquefoil. Fairly common, South Fields. 762.

Prunus americana Marshall, wild plum. Scattered in South Fields, Scotch pine plantation, and along the town road (formerly a thicket in the NW corner). 144, 372, 962, 1020, 10170, 10193.

P. pensylvanica L.f., pin cherry. Occasional, edges and fields; most common along the driveway. 371, 1171.

P. serotina Ehrh., black cherry. Occasional seedlings and saplings. 370.

P. virginiana L. var. *virginiana*, choke cherry. Common, fields and edges. 369, 10181.

Rosa blanda Aiton, meadow rose. Local, east end of Slough. 763.

R. palustris Marshall, swamp rose. Rare, riverside meadow in front of cabin.

Rubus allegheniensis L.H. Bailey, common blackberry. Common, edges. 10007.

R. hispidus L., swamp dewberry. Locally common among jack pine in SE corner. 10034, 10081.

R. idaeus L. var. *strigosus* (Michx.) Maxim., red raspberry. Occasional, forming thickets near the cabin. 954.

- R. occidentalis* L., black raspberry. Occasionally forming thickets near cabin and along driveway and near cabin. 957.
- R. perspicuus* L. Bailey, Great Lakes dewberry. Rare, near cabin and in kettle hole (Ice Pond) in SE corner. 570, 584. Identification tentative.
- R. pubescens* Raf., dwarf raspberry. Locally common, central Slough. 10052.
- Sorbus americana* Marshall, American mountain-ash. Seedlings occasionally encountered, especially in the Scotch pine plantation. 467.
- Spiraea alba* Du Roi var. *alba*, meadowsweet. Occasional, South Fields and near the road.
- S. tomentosa* L. var. *rosea* (Raf.) Fernald, hardhack; steeplesh. Occasional, eastern South Fields, also near central Slough. 842, 1060.

FABACEAE (Legume Family)

- Amphicarpaea bracteata* (L.) Fernald, hog-peanut. Common on steep riverbanks. 424, 750.
- Apios americana* Medik., ground-nut. Common in NE corner along the town road. 412, 11552. Near the species' northern range limit.
- Desmodium glutinosum* (Willd.) A.W. Wood, tick-trefoil. Occasional in woods along river, especially near east border. 793.
- Lathyrus ochroleucus* Hook., wild-pea. Occasional, sunny riverbanks.
- L. palustris* L., marsh-pea. Local, sunny riverside at Leaning Pine. 535, 767, 10039. Near the species' northern range limit.
- **Medicago lupulina* L., black medick. Uncommon along driveway and the town road. 757.
- **M. sativa* L., alfalfa. Rare in South Fields. 378, 2324.
- **Melilotus alba* Medik., white sweet clover. Common along the town road and driveway; occasional in South Fields. 796.
- **M. officinalis* (L.) Lam., yellow sweet clover. Rare in driveway. 797.
- **Trifolium aureum* Poll., yellow hop clover. One clump along Logan Road, 16 August 2003, 15047, UWSP.
- **Trifolium hybridum* L., alsike clover. Occasional, South Fields. 366.
- **T. pratense* L., red clover. Common, fields and roadsides. 738.
- **T. repens* L., white clover. Common, fields and roadsides. 10037.
- **Vicia villosa* Roth, hairy vetch. Fairly common, fields and roadsides. 573, 789, 2141, 2790.

GERANIACEAE (Geranium Family)

- Geranium maculatum* L., wild geranium. Rare in steep riverbank woods along The road in NE corner. 727. At the species' northern range limit.

OXALIDACEAE (Wood-sorrel Family)

- Oxalis stricta* L., yellow wood-sorrel. Fairly common, fields and openings. 703, 882.

RUTACEAE (Citrus Family)

- Zanthoxylum americanum* Mill., prickly-ash. Common thicket-forming shrub, but now less abundant than in the 1970s. 10009. Near the species' northern range limit.

POLYGALACEAE (Milkwort Family)

- Polygala paucifolia* Willd., fringed polygala. Abundant in 1970s (less so in 2003), upland woods and edges. 711, 873, 10172.
- P. sanguinea* L., field milkwort. Rare in dry "barrens" area in far southwest corner with jack pine, 1993. 10779.

EUPHORBIACEAE (Spurge Family)

- **Acalypha rhomboidea* Raf., three-seeded mercury. Rare, in red pine plantation north of east-central Slough. 947. Still present in early 1980s, but gone by late 1990s.
- **Chamaesyce glyptosperma* (Engelm.) Small, wartweed. Occasional along the road and driveway and in SW part of South Fields. 362, 469.
- **C. maculata* (L.) Small, hairy wartweed. Uncommon along the road. 470.

CALLITRICHACEAE (Water-starwort Family)

- Callitriche palustris* L., water-starwort. Uncommon in riverside mud. 473.

ANACARDIACEAE (Cashew Family)

Rhus hirta (L.) Sudw., staghorn sumac. Occasional shrub, edges. Now much less common than in the 1960s and 1970s. 471.

Toxicodendron rydbergii (Rydb.) Greene, poison-ivy. Occasional, riverbanks. 10011.

AQUIFOLIACEAE (Holly Family)

Ilex verticillata (L.) A. Gray, winterberry holly. Rare, east-central Slough; also a single plant on dry bank a few meters south of the cabin persisting from 1977 to 2004. 812, 936.

CELASTRACEAE (Staff-tree Family)

Celastrus scandens L., climbing bittersweet. Occasional along river in eastern part. 444.

ACERACEAE (Maple Family)

**Acer negundo* L. var. *negundo*, box-elder. Occasional seedlings along the town road and in Scotch pine plantation. 1821.

A. rubrum L. var. *rubrum*, red maple. Common upland tree. 26, 820, 1777.

A. saccharinum L., silver maple. Occasional riverside tree. Some individuals look intermediate to red maple and could be the hybrid *A. X freemanii* E. Murray.

A. saccharum Marshall var. *saccharum*, sugar maple. Uncommon tree, mostly in rich soil near east border. 1096.

A. spicatum Lam., mountain maple. In 1970s and 1980s (Fig. 4), rare under hemlocks and white cedar in shade on steep, north-facing riverbank; gone by the 1990s. 529.

BALSAMINACEAE (Touch-me-not Family)

Impatiens capensis Meerb., spotted touch-me-not. Common, riversides and the Slough. 861.

VITACEAE (Grape Family)

Parthenocissus vitacea (Knerr) Hitchc. Virginia creeper. Uncommon along central and far eastern Slough. 1090.

Vitis riparia Michx., wild grape. Common, riversides. 951.

TILIACEAE (Basswood Family)

Tilia americana L., basswood. Fairly common, often large riverside tree. 955.

HYPERICACEAE (St. John's-wort Family)

Hypericum majus (A. Gray) Britton. Occasional, jack pine savanna in SE corner. 386, 452.

**Hypericum perforatum* L., common St. John's-wort. Introduced; see note under *Ratibida pinnata*. First noted in July 1978 (1061, 1072). Agressively spreading starting in the 1990s, eradication "campaign" started in 2003.

H. punctatum Lam., spotted St. John's-wort. Locally common, Ironwood Rapids to east end of Slough. 133.

H. pyramidatum Aiton, great St. John's-wort. Occasional, riverside meadows and swale in South Fields. 830.

CISTACEAE (Rockrose Family)

Lechea intermedia Britton, pinweed. Occasional, dry soil throughout South Fields. 442, 4703

VIOLACEAE (Violet Family)

Viola adunca Sm., hook-spur violet. Occasional, dry soil throughout South Fields. 964, 1111, 1128, 10169.

V. blanda Willd. var. *palustriformis* A. Gray, sweet white violet. Common, woods and fields. 656, 1152, 14517 (UWSP).

V. cucullata Aiton, marsh blue violet. Occasional, riversides (as at Hawthorn Glen) and in central Slough. 1173, 10187.

V. labradorica Schrank, dog violet. Common, woods and edges. 1172, 10183.

V. lanceolata L. var. *lanceolata*, lance-leaved violet. Rare in jack pine savanna in SE corner. 1110.

V. macloskeyi F.E. Lloyd subsp. *pallens* (Ging.) M.S. Baker, smooth white violet. Uncommon, central Slough and Ironwood Rapids swale. 27, 655, 10201.

V. pubescens Aiton, yellow violet. Occasional, rich riverside woods and near the Slough. 1156, 10166.

ONAGRACEAE (Evening-primrose Family)

- Circaea alpina* L. subsp. *alpina*, enchanter's-nightshade. Local, woods along west-central Slough. 828.
C. lutetiana L. subsp. *canadensis* (L.) Asch. & Magnus, enchanter's-nightshade. Rare, rich woods on East Shelf. 780, 846.
E. coloratum Biehler, purple-leaved willow-herb. Occasional, Slough and riversides. 401, 10051.
E. leptophyllum Raf., bog willow-herb. Local, west-central Slough. 395.
Ludwigia palustris (L.) Elliott, water-purslane. Fairly common, riverside mud. 211.
Oenothera biennis L. s.l., evening-primrose. Fairly common, fields. 286, 357, 363, 833, 849.
O. perennis L., sundrops. Occasional, South Fields, particularly in SE corner. 142, 748.

HALORAGACEAE (Water-milfoil Family)

- Myriophyllum sibiricum* Kom., common water-milfoil. Fairly common in river in 1970s. Gone by 2000.

ARALIACEAE (Ginseng Family)

- Aralia hispida* Vent., bristly sasparilla. Rare; a single plant near the cabin in 1976. 966.
A. nudicaulis L., wild sasparilla. Common, pine woods. 1121.
A. racemosa L., spikenard. Occasional, rich river-side woods, particularly on East Shelf. 845.
Panax trifolius L., dwarf ginseng. Occasional along river and Slough. 712.

APIACEAE (Parsley Family)

- Cicuta bulbifera* L., bulblet-bearing water-hemlock. Rare in riverside mud. 410.
C. maculata L., spotted water-hemlock. Fairly common, riversides and central Slough. 788.
Cryptotaenia canadensis (L.) DC., honewort. Occasional in rich south riverbank woods. 749.
**Daucus carota* L., queen anne's lace. Rare weed at cabin; seen in August 1978. Collected in 1997 (12456) at end of Redwood Lane; again in flower on 28 Sept. 2002.
Hydrocotyle americana L., water-pennywort. Fairly common along river and Slough. 428.
Osmorhiza claytonii (Michx.) C.B. Clarke, sweet cicely. Occasional in woods along river and Slough. 813.
Sanicula marilandica L., black snakeroot. Fairly common, rich riverside woods. 880, 10199.
Sium suave Walter, water-parsnip. Locally common, wettest part of Slough west of driveway. 10000.

CORNACEAE (Dogwood Family)

- Cornus alternifolia* L.f., pagoda dogwood. Occasional, edges and riversides, mostly north of river. 859.
C. amomum Mill. var. *schuetzeana*, silky dogwood. Rare, sunny riverside at Leaning Pine. 774. Near the species' northern range limit.
C. canadensis L., bunchberry. Occasional, shaded woods along river and Slough. 426, 716.
C. foemina Mill. subsp. *racemosa* (Lam.) J.S. Wilson, gray dogwood. Locally common, forming thickets on the West Shelf and in the NE corner. 792.
C. rugosa Lam., round-leaved dogwood. Local, steep riverbank in NE corner along the road. 860.

MONOTROPACEAE (Indian-pipe Family)

- Monotropa hypopithys* L., pinesap. Rare in south riverbank woods at west border; also a patch near sauna. 1073, 1097, 1869.
M. uniflora L., Indian-pipes. Occasional, woods. 437, 785, 851, 1070.

PYROLACEAE (Wintergreen Family)

- Chimaphila umbellata* (L.) W.P.C. Barton subsp. *cisatlantica* (S.F. Blake) Hultén, pipsissewa. Uncommon, dry woods and banks. The clone on the switchback trail from cabin down to river first appeared in 1976, increased in luxuriance until about 1990, and has been slowly declining since. 462.
Moneses uniflora (L.) A. Gray, one-flowered pyrola. Several plants seen in Scotch pine plantation, 4 July 1981. Near the species' southern range limit.
Orthilia secunda (L.) House, one-sided pyrola. Rare, Scotch pine plantation. 465.
Pyrola chlorantha Sw., green-flowered pyrola. Local, shaded, north-facing riverbank. 784.

P. elliptica Nutt., shinleaf. Fairly common, woods and edges. 783.

ERICACEAE (Heath Family)

Epigaea repens L., trailing arbutus. Uncommon, pine woods south of river, such as east of Hawthorn Glen. 24, 11200.

Gaultheria procumbens L., wintergreen. Fairly common, dryish woods. 841.

Vaccinium angustifolium Aiton, early blueberry. Scattered plants in fields and openings. 356, 970, 1165.

V. myrtilloides Michx., velvet-leaved blueberry. Rare. 1774.

PRIMULACEAE (Primrose Family)

Lysimachia ciliata L., fringed loosestrife. Fairly common, moist woods along river and Slough. 766.

L. quadrifolia L., whorled loosestrife. Abundant, upland woods and edges. 775.

L. terrestris (L.) Britton, Stearns & Poggenb., swamp loosestrife. Rare, riverside mud. 1058.

L. thyrsiflora L., tufted loosestrife. Local, riverside mud on West Shelf. 603.

Trientalis borealis Raf. subsp. *borealis*, starflower. Common, upland woods. 733, 10168.

GENTIANACEAE (Gentian Family)

Gentiana andrewsii Griseb. var. *andrewsii*, closed gentian. Common, riverside meadows and moist areas in fields. 377, 11664 (Brule).

Halenia deflexa (Sm.) Griseb., spurred-gentian. Rare in rich south riverbank woods opposite cabin. 367. Not seen here since 1970s. Near the species' southern range limit.

OLEACEAE (Olive Family)

Fraxinus nigra Marshall, black ash. Local in rich riverbank woods opposite cabin. 1087.

F. pennsylvanica Marshall, green ash. Common tree along river and Slough; occasional in fields. 935.

APOCYNACEAE (Dogbane Family)

Apocynum androsaemifolium L., spreading dogbane. Occasional, fields and disturbed areas. 943.

ASCLEPIADACEAE (Milkweed Family)

Asclepias incarnata L. subsp. *incarnata*, swamp milkweed. Occasional along river and in moist places in South Fields. 772.

A. syriaca L., common milkweed. Fairly common, fields and roadsides. 10023.

A. tuberosa L. subsp. *interior* Woodson, butterfly-weed. One flowering plant seen in the south field in July 1975, and not since. Near the species' northern range limit.

A. verticillata L., whorled milkweed. Locally common, NE part of South Fields. 168, 2415, 4704. Near the species' northern range limit.

CONVOLVULACEAE (Morning-glory Family)

Calystegia spithamea (L.) Pursh, upright bindweed. Fairly common, fields and roadsides. 723.

CUSCUTACEAE (Dodder Family)

Cuscuta gronovii Willd., dodder. Local, riverbank between the West Shelf and Leaning Pine; a parasite on *Amphicarpaea bracteata*. 429, 915, 2417. Near the species' northern range limit..

BORAGINACEAE (Borage Family)

Hackelia virginiana (L.) I.M. Johnston, beggar's-lice. Rare but increasing; woods near cabin and along driveway. 4721, 9999. First appearing in 1980s and apparently spread by deer.

**Lappula squarrosa* (Retz.) Dumort., stickseed. Rare weed in driveway gravel in the 1970's. 373, 474.

VERBENACEAE (Vervain Family)

Phryma leptostachya L., lopseed. Occasional, moist riverside woods and weedy around cabin. 778.

Verbena hastata L., blue vervain. Occasional, fields and openings, particularly near east end of Slough. 810.

LAMIACEAE (Mint Family)

- **Hedeoma hispida* Pursh, mock pennyroyal. Uncommon weed along the road and driveway. 475. Gone by the late 1990s.
- Lycopus americanus* W.P.C. Barton, cut-leaved water-horehound. Fairly common, riversides and swales in fields. 454, 892, 10032.
- L. uniflorus* Michx., northern bugleweed. Uncommon, riverside meadows at Hawthorn Glen and West Shelf. 847, 10043.
- Mentha arvensis* L. var. *canadensis* (L.) Kuntze, wild mint. Fairly common, riversides; also along the Slough. 924.
- **Monarda fistulosa* L. subsp. *fistulosa*, wild bergamot; bee balm. Fairly common, fields and clearings. 852.
- Physostegia virginiana* (L.) Benth. subsp. *virginiana*, false dragonhead. Fairly common, riverside meadows. 402, 439. Near the species' northern range limit.
- **Prunella vulgaris* L., heal-all. Common, fields and openings. 768.
- Scutellaria lateriflora* L., side-flowered skullcap. Fairly common, riversides; also along central Slough. 450.
- Stachys tenuiflora* Willd. var. *tenuiflora*, rough hedge-nettle. Local, sunny riverbanks at Leaning Pine and Ironwood Rapids. 447.

SOLANACEAE (Nightshade Family)

- Physalis heterophylla* Nees var. *heterophylla*, clammy ground-cherry. Fairly common, fields. 808, 10030.
- P. virginiana* Mill. var. *virginiana*, Virginia ground-cherry. Fairly common, fields. 816.
- **Solanum dulcamara* L., bittersweet nightshade. Occasional, riversides in eastern part; also in Slough at the driveway crossing. 566, 891.
- S. ptycanthum* Dunal, black nightshade. Uncommon, fields and openings (such as near cabin). 406, 967, 12458.

SCROPHULARIACEAE (Figwort Family)

- Castilleja coccinea* (L.) Sprengel, Indian paint-brush. Rare, hill in central South Fields. 1123.
- Chelone glabra* L., turtlehead. Fairly common, riverside meadows. 415.
- Gratiola neglecta* Torr., hedge-hyssop. Occasional, riverside mud. 440.
- Lindernia dubia* (L.) Pennell, false pimpernel. Rare, riverside mud. 441.
- Melampyrum lineare* Desr., cow-wheat. Local, pine woods just west of cabin. 461.
- Mimulus ringens* L. var. *ringens*, monkey flower. Fairly common, riverside meadows. 837.
- Pedicularis lanceolata* Michx., swamp lousewort. Fairly common, riverside meadows. 403.
- **Verbascum thapsus* L., common mullein. Occasional, fields, openings, and roadsides. 901.
- Veronica americana* Benth., American brooklime. Occasional, riverside banks and mud flats. 834.

PLANTAGINACEAE (Plantain Family)

- **Plantago major* L., common plantain. Occasional weed, driveway and the road. 10054.
- P. rugelii* Decne., Rugel's plantain. Rare, South Fields. 374.

RUBIACEAE (Madder Family)

- Galium asprellum* Michx., rough bedstraw. Rare, along river at Hawthorn Glen and East Shelf. 848.
- G. boreale* L., northern bedstraw. Rare, steep, south-facing riverbank (Leaning Pine). 791.
- G. obtusum* Bigelow subsp. *obtusum*, wild madder. Fairly common along river; also central Slough. 575, 587. At the species' northern range limit.
- G. tinctorium* L., swamp bedstraw. Local, central Slough; still present on 15 Sept. 2002. 756.
- G. triflorum* Michx., sweet-scented bedstraw. Common, upland woods and edges. 865.
- Mitchella repens* L., partridge-berry. Common, upland woods and edges. 782.

CAPRIFOLIACEAE (Honeysuckle Family)

- Diervilla lonicera* Mill., northern bush-honeysuckle. Common, upland woods and edges. 758.
- Linnaea borealis* L. subsp. *longiflora* (Torr.) Hultén, twinflower. Rare, in hemlock-white pine woods just west of sauna. Seen from 1977-1982 and not later. 427.

- **Lonicera X bella* Zabel, Bell's honeysuckle. Uncommon; several plants in red pine plantation east of driveway. 10056.
L. canadensis Marshall, Canada honeysuckle. Occasional, upland woods. 694.
L. dioica L. var. *dioica*, red honeysuckle. Occasional, woods and edges; by garage. 1122, 10195. Noted as "common" in 1979, it is now uncommon here.
L. hirsuta Eaton, hairy honeysuckle. Rare, rich mesic woods on East Shelf. 1155.
Sambucus canadensis L. var. *canadensis*, common elderberry. Rare, along central Slough. 829.
S. racemosa L. subsp. *pubens* (Michx.) House, red-berried elder. Occasional, moist, shaded coniferous woods along Slough and river. 701, 817.
Triosteum aurantiacum E.P. Bicknell, horse-gentian. Rare, rich woods on East Shelf. 1853.
Viburnum acerifolium L., maple-leaved viburnum. Occasional, upland, especially pine woods. 850, 1084.
V. lentago L., nannyberry. Local, western and far east end of Slough (by river). 932.
V. trilobum Marshall, highbush cranberry. One small plant noted in Scotch pine plantation, July 1981.

CAMPANULACEAE (Bellflower Family)

- Campanula aparinoides* Pursh. marsh bellflower. Uncommon, riversides at Hawthorn Glen, Ironwood Rapids, and east end of Slough. 280, 896.
C. rotundifolia L., harebell. Rare, dry, south-facing riverbank at Leaning Pine. 423, 853.

LOBELIACEAE (Lobelia Family)

- Lobelia cardinalis* L. var. *cardinalis*, cardinal flower. Occasional, riverside meadows. 405, 11554 (Brule). Near the species' northern range limit.
L. inflata L., Indian-tobacco. Fairly common, fields and openings. 385.
L. siphilitica L., great lobelia. Common along river and in along eastern part of Slough. 421, 11553 (Brule).

ASTERACEAE (Composite Family)

- Achillea millefolium* L., yarrow. Fairly common, fields and roadsides. 795.
 **Ambrosia artemisiifolia* L., common ragweed. Occasional, fields and roadsides. 958.
Anaphalis margaritacea (L.) Benth. & Hook. f., pearly everlasting. Occasional in South Fields. 431, 927, 4705.
Antennaria howellii Greene subsp. *neodioica* (Greene) R.J. Beyer, field pussy-toes. Common, fields and dry openings and banks. 693, 1743.
A. parlinii Fernald subsp. *fallax* (Greene) R.J. Bayer & Stebbins. Uncommon, dry banks at Leaning Pine and elsewhere. 1164, 1724.
 **Arctium minus* (Hill) Bernh., burdock. Under a large red maple 50 meters east of cabin; present here (re-seeding) from 1977-1993. 950, 10194. Present in 2001 downslope from the 1970s colonies.
Artemisia campestris L. subsp. *caudata* (Michx.) H.M. Hall & Clem., tall wormwood. Throughout the South Fields, most common in dry SW corner. 911.
Aster ciliolatus Lindley. Local near garage and near Hawthorn Glen. 969.
A. lanceolatus Willd., paniced aster. Locally common, eastern Slough and at Hawthorn Glen. 929.
A. lateriflorus (L.) Britton, calico aster. Common, riversides, along Slough, and moist old fields. 171, 361, 12464.
A. macrophyllus L., large-leaved aster. Common, upland woods.
A. oolentangiensis Riddell, azure aster. Fairly common, fields and openings. 285, 10025.
A. puniceus L., purple-stemmed aster. Locally common, central and eastern Slough and by river at Hawthorn Glen. 355.
A. sagittifolius Willd., arrow-leaved aster. Fairly common, fields and openings. 283.
A. umbellatus Mill., flat-topped aster. Fairly common, riverside meadows. 284.
Bidens cernuus L., beggar-ticks. Occasional, north bank riverside meadows. 10038.
B. frondosus L. Fairly common, riversides and central Slough. 364, 10018, 10041.
 **Cichorium intybus* L., chicory. One flowering plant noted near cabin, 21 July 1975.
 **Cirsium arvense* (L.) Scop., Canada thistle. Occasional, openings and dry banks. 425.
C. muticum Michx., swamp thistle. Local, springy area at east end of Slough. 413.

- **C. palustre* (L.) Scop., European swamp thistle. One flowering plant along Logan Road, 31 July 2002, 14732, UWSP.
- **C. vulgare* (Savi) Tenore, bull thistle. Uncommon weed around cabin. 917.
- Conyza canadensis* (L.) Cronq. var. *canadensis*, horseweed. Occasional, South Fields and along the road and driveway. 164, 416.
- Erigeron philadelphicus* L., common fleabane. Occasional, moist fields, openings, and banks. 268, 1091, 2143.
- E. strigosus* Willd., daisy fleabane. Common, fields. 776, 1066, 4708, 10022.
- Eupatorium maculatum* L., joe-pye weed. Occasional, riverside meadows. 10013.
- E. perfoliatum* L. var. *perfoliatum*, boneset. Fairly common, riverside meadows; also central Slough and moist parts of South Fields. 815.
- E. rugosum* Houtt. var. *rugosum*, white snakeroot. Fairly common, riversides. 365.
- Euthamia graminifolia* (L.) Nutt. var. *graminifolia*, grass-leaved goldenrod. Fairly common, fields and openings. 920.
- Gnaphalium obtusifolium* L. var. *obtusifolium*, sweet everlasting. Uncommon, fields and openings. 928.
- Helenium autumnale* L. var. *autumnale*, sneezeweed. Fairly common, riversides. 916.
- Helianthus giganteus* L., tall sunflower. Uncommon in woods west of cabin, also on both riverbanks at the east border. 390.
- **Hieracium aurantiacum* L., orange hawkweed. Abundant, fields and roadsides. 595.
- H. kalmii* L., Canada hawkweed. Uncommon, South Fields. 380.
- **H. piloselloides* Vill., king devil. Uncommon, SW part of South Fields. 594, 596, 666.
- H. scabrum* Michx., rough hawkweed. Occasional, fields and openings. 165, 10012
- Krigia biflora* (Walter) S.F. Blake, two-flowered cynthia. Local, dry, south-facing riverbank at Leaning Pine, and dry SW corner of South Fields. 547.
- Lactuca biennis* (Moench) Fernald, blue lettuce. Rare, along central Slough. 396.
- L. canadensis* L., wild lettuce. Fairly common, fields and openings. 430, 12460.
- **Leucanthemum vulgare* Lam., ox-eye daisy. Occasional, South Fields, the road, and driveway. 10004.
- **Matricaria discoidea* DC., pineapple-weed. Weed along the town road, seen 6 June 1980.
- Packera aurea* (L.) A.Löve & D. Löve, golden ragwort. Fairly common, rich woods and meadows along the river. 1112, 1975.
- P. paupercula* (Michx.) A. Löve & D. Löve, balsam ragwort. Rare, moist spot in South Field. 613.
- Prenanthes alba* L., white lettuce. Occasional, upland woods and edges. 418, 12462.
- Rudbeckia hirta* L. var. *pulcherrima* Farw., black-eyed susan. Fairly common, fields and clearings. 825.
- R. laciniata* L., green-headed coneflower. Occasional, riverbank meadows. 858.
- Solidago canadensis* L., Canada goldenrod. Fairly common, fields and openings. 281, 921.
- S. flexicaulis* L., zigzag goldenrod. Local, rich riversides at Hawthorn Glen and West Shelf. 387.
- S. gigantea* Aiton, late goldenrod. Fairly common, fields and openings. 282, 918, 12463.
- S. juncea* Aiton, early goldenrod. Occasional, fields and openings. 188.
- S. nemoralis* Aiton, gray goldenrod. Fairly common, dryish fields and openings. 919, 10024.
- S. patula* Willd. var. *patula*, rough-leaved goldenrod. Locally common, seeps at east end of Slough and riverbank at Leaning Pine. 389, 2711, 10045. Near the species' western range limit.
- **Sonchus arvensis* L., common sow-thistle. Rare weed along the road; formerly near cabin. 10046.
- **Taraxacum leavigatum* (Willd.) DC., red-seeded dandelion. Occasional weed near cabin. 516, 726.
- **T. officinale* Weber, common dandelion. Occasional, fields and openings. 725, 10184.
- **Tragopogon dubius* Scop., goat's-beard. Occasional along the town road and driveway; rare in South Fields. 799.

ACKNOWLEDGMENTS

I thank my brother Wyatt for all his help at "Butternut Pines" in various ways over the years, and I dedicate this paper to my parents Louis Judziewicz (1921–1995) and Lucinda M. Judziewicz (nee Jagodzinski). The support of Theodore S. Cochrane, Merel R. Black, and Paul E. Berry of the University of Wisconsin-Madison herbarium is gratefully acknowledged, as is the encouragement of Robert W. Freckmann of the University of Wisconsin-Stevens Point. Frank Bowers (Mountain Home, Arkansas) kindly identified the bryophytes.

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REVIEW

Nold, Robert. October, 2003. *Columbines: Aquilegia, Paraquilegia, and Semiaquilegia*. 193 pp., 45 color photos, 8 watercolors, 4 line drawings. Hardcover, ISBN 0-88192-588-8; \$24.95. Timber Press, Inc., 133 SW Second Avenue, Suite 450, Portland, OR 97204; www.timberpress.com, with credit card facilities.

This company is renowned for the excellent quality of its books, at affordable prices. I don't know how they do it, but all of Botany is the better for it.

The focus of this work is on horticulture. But the taxonomy is not slighted. There are keys and (after a fashion) descriptions of the taxa. The keys are divided up geographically: separate keys for Asian, European, and North American species. If you don't know the true origin of your plant, you will have to run it down in all three places.

Semiaquilegia is a spurless kind of columbine, comprised of but one species, *Semiaquilegia adoxoides*. *Paraquilegia* is likewise spurless and has about half a dozen species. In both these Asian genera, the species are discussed in detail, but there are no keys offered.

All this good information is offered in a friendly, conversational style. The author leads you through some of the nomenclatural tangles so gently, you don't realize until the end of the paragraph how many facts are packed into his sentences.

There's a very thorough bibliography, not stinting on the technical monographs, a glossary, and a list of seed sources, followed by a complete index. The book deserves a place both on the gardener's shelf and in the herbarium library.

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FIFTEEN YEARS OF PLANT COMMUNITY DYNAMICS DURING A NORTHWEST OHIO OAK SAVANNA RESTORATION

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ABSTRACT

Midwest oak savanna communities are noted for their unusual plant assemblages, but these communities have been reduced by more than 98% because of changing land uses and conversion to closed-canopy forests. We initiated an ongoing 15-year experiment in 1988 to restore a 40-ha black oak (*Quercus velutina*) savanna by applying burn treatments that historically maintained this vegetation type. Groundlayer composition changed significantly for both the burn treatment and the control, with the burn treatment exhibiting slight increases in herbs such as wild lupine (*Lupinus perennis*) and hairy puccoon (*Lithospermum carolinense*), both of which are species requiring greater insolation. Burn treatments differentially affected different plant community characteristics during the 15-year period, with some characteristics such as sapling density decreasing and other characteristics like species richness remaining comparatively unchanged. Oak overstory density was not affected by burn treatments, and reductions in oak density of 33-50% are needed for consistency with presettlement savanna structure to enhance the diversity of sunny and shady microsites characteristic of oak savannas. Results support the continuation of experimental restoration treatments in this savanna, and indicate further research is needed to clarify long-term patterns of temporal change in oak savanna vegetation.

INTRODUCTION

Oak savanna communities historically covered more than 11 million hectares in the midwestern United States (Nuzzo 1986). These fire-, drought-, or edaphic-maintained communities consisted of scattered oak canopies, brushy or open understories, and diverse groundlayers of both prairie and forest species (Bray 1960; Heikens & Robertson 1994; Leach & Givnish 1999). By 1985, changing land-uses and fire suppression had reduced oak savanna to 0.02% of its presettlement extent in the Midwest (Nuzzo 1986). Despite the sharp decline in the areal extent and quality of oak savannas, regions supporting oak savannas still contain notable plant diversity. For example, Leach & Givnish (1999) surveyed 22 savanna remnants (42 ha total) in southern Wisconsin and found that the remnants supported 507 native plant species (~ 27% of Wisconsin's native flora). Because of their unique floral assemblages and current rareness, there has been

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increasing interest since the 1980s in restoring oak savannas to the Midwest landscape (White 1983; Anderson 1998; Jones 2000).

Since 1988, the Toledo Area Metroparks have been using experimental treatments to restore oak savannas in Oak Openings Preserve, within the Oak Openings region in northwest Ohio (Abella et al. 2001). The Oak Openings region occupies glacial lakeplain sands, and based on presettlement land survey records historically consisted of a mosaic of 44% oak savanna (4–43 trees ha⁻¹), 23% oak woodland (> 43 trees ha⁻¹), 7% oak barrens (1–3 trees ha⁻¹), and 27% wet prairie (< 1 tree ha⁻¹; Brewer & Vankat 2001). Oak savannas in this region not converted to other land uses became closed-canopy forests through the 1900s because of fire suppression, resulting in declines in ground-flora diversity (Abella et al. 2001). Restoration treatments by the Metroparks have entailed reducing canopy cover and sapling densities and reinstating disturbance regimes, such as fire, that historically maintained oak savanna plant communities (Nuzzo 1986). Despite the historic widespread distribution and floral diversity of oak savannas, there are few long-term data available on the temporal dynamics of savanna vegetation.

We have been studying the community dynamics of Mary's Savanna, a 40-ha black oak savanna in Oak Openings Preserve, during an ongoing 15-year restoration experiment initiated in 1988 (Brewer & Grigore 1993). This savanna, similar to other savannas across the Midwest (Nuzzo 1986), had become closed-canopy forest and lacked savanna structure before restoration. Prescribed burn treatments have been applied to 30 ha of this savanna since 1988 with a goal of achieving a community structure resembling that of a presettlement savanna in this region, while 10 ha of the savanna have served as a control. This study was undertaken in Mary's Savanna to document plant community dynamics over a 15-year period to better understand temporal changes of savanna vegetation and plant responses to reintroductions of disturbance regimes that historically maintained this vegetation type.

METHODS

Mary's Savanna is located in the southern section of Oak Openings Preserve (41°32'15"N, 83°51'00"W), western Lucas County, northwestern Ohio (Fig. 1). Soils in the savanna are mapped as mixed, mesic Aquic and Typic Udipsamments of the Ottokee and Oakville series (Stone et al. 1980). The mapped series were confirmed in 1988 by sampling soils at five locations in Mary's Savanna and comparing the soil characteristics to series descriptions in the soil survey (Stone et al. 1980). Based on increment cores collected from five dominant oaks, Mary's Savanna established about 1900, possibly following farm abandonment or cessation of livestock grazing (Moseley 1928). In 1821, the area supported oak savanna according to government land survey records (Brewer & Vankat 2001).

Five permanent 0.05-ha plots (20 m × 25 m) were established in Mary's Savanna in 1988 following methods documented in Brewer & Grigore (1993). Three plots were established in the burn treatment, and two plots were established in the control. Pre-treatment data were collected in 1988, and the plots were re-sampled at 1–4 year intervals in 1988, 1990, 1991, 1993, 1997–2000, and 2002. Burn treatments were applied at 1–4 year intervals in the following years and months: 1988 (November), 1989 (April), 1990 (April), 1993–1994 (November), 1997 (March), 1998 (November), and 2001 (November). Relative humidities at ignition times ranged from 32–72%, with winds typically < 16 km/hr out of the south.

On each plot, we determined the species and measured the diameter to the nearest cm at 1.37 m for each tree greater than 1 cm diameter. We determined average percent canopy cover using a den-

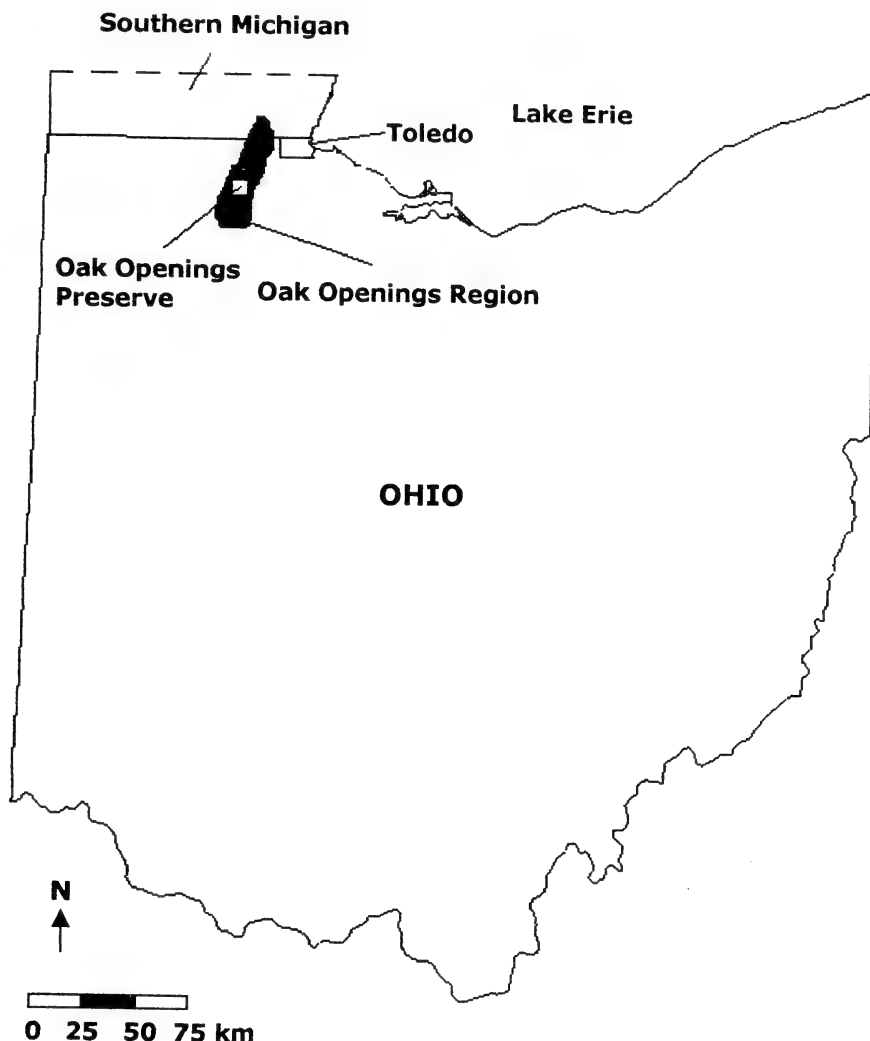


FIGURE 1. Location of the 1,496-ha Oak Openings Preserve and the 40,000-ha Oak Openings region of northwestern Ohio.

sitometer (Geographic Resource Solutions, Arcata, CA), based on measurements to the nearest 5% cover at eight locations at 5-m intervals along the plot diagonal. In six 1-m² subplots located at the plot corners and at the centers of the long plot axes, we categorized the areal percent cover of vascular plant species at 1% intervals up to 5% cover and then at 5% intervals for cover greater than 5%. We surveyed the entire 0.05-ha plot for species not occurring in subplots and categorized the percent cover of these species on a plot basis. In 2002, we increased the number of subplots per plot to 15 to refine plant frequency estimates. Plants not readily identifiable in the field were collected, pressed, and when possible identified to species. Nomenclature follows Voss (1972; 1985; 1996). We measured the thickness of the Oi and Oe+a soil horizons (Soil Survey Division Staff 1993), hypothesized to decrease following burn treatments, by excavating the layers with a 20-cm long handshovel at six locations along the perimeter of each plot.

To test the null hypothesis of no change in plant community characteristics between pre- (1988) and post-treatment (2002) within the burn and control treatments, we compared mean black oak basal area, species richness, Shannon's diversity index (H' ; McCune & Mefford 1999), and thickness of the Oi and Oe+a horizons between years for each treatment using two-tailed paired t -tests. We evaluated the null hypothesis of no change in groundlayer composition between pre- and post-treatment for each treatment using blocked multi-response permutation procedure tests in the software PC-ORD (McCune & Mefford 1999). Multi-response permutation procedures are multivariate, non-parametric tests that evaluate the null hypothesis of no difference in species composition between groups using a randomization procedure (Zimmerman et al. 1985). We used the blocked test (Euclidean distance and medians aligned) variation of multi-response permutation procedures to accommodate our paired-sample data (McCune & Mefford 1999). The data matrix consisted of mean percent cover of each species, and data for each plot were relativized by the maximum species percent cover for that plot (McCune & Mefford 1999).

RESULTS AND DISCUSSION

Black oak comprised 21.9 ± 1.1 (mean ± 1 standard deviation) $\text{m}^2 \text{ha}^{-1}$ basal area (94% relative basal area) in the burn treatment post-treatment in 2002, which was not significantly different ($t = 0.69$, $P = 0.56$) from $20.3 \pm 3.1 \text{ m}^2 \text{ha}^{-1}$ basal area (95% relative basal area) pre-treatment in 1988. Mean black oak basal area for the control also did not differ ($t = -2.76$, $P = 0.56$) between 2002 ($18.0 \pm 10.4 \text{ m}^2 \text{ha}^{-1}$; 93% relative basal area) and 1988 (21.5 ± 8.6 ; 95% relative basal area). Densities of overstory black oak (> 20 cm diameter) also did not change for either treatment (Fig. 2). Burn treatments in this savanna have not affected basal area or densities of overstory black oak presumably because of the thick bark of this species (Easterly 1969). These results are consistent with those of White (1983), who found that 13 years of annual burns did not decrease overstory oak density in a Minnesota savanna.

Burn treatments, however, have drastically changed the community structure of Mary's Savanna during the 15-year period by eliminating small-diameter trees (Fig. 2). In contrast, post-treatment density in the 1–5 cm diameter class of black cherry (*Prunus serotina*) and sassafras (*Sassafras albidum*) exceeded 500 trees ha^{-1} in control plots (Fig. 2). These densities are similar to those reported by Larch & Sakai (1985) for minimally disturbed oak stands of southeastern Michigan. Post-treatment community structure of the control includes several layers of large and small trees, while community structure of the burn treatment is two-layered and consists of a canopy and a groundlayer (Fig. 3). The relatively open understory structure of the burn treatment resembles descriptions of some pre-settlement savannas in this region, although overstory oak densities are currently about twice as high as was typical of area presettlement savannas (Brewer & Vankat 2001).

Post-treatment groundlayers in both the burn and control plots are dominated by bracken fern (*Pteridium aquilinum*), Pennsylvania sedge (*Carex pensylvanica*), shrubs such as hillside blueberry (*Vaccinium pallidum*), and seedlings of black oak and other species (Table 1). Forbs like cinquefoil (*Potentilla simplex*), frostweed (*Helianthemum bicknellii*), flowering spurge (*Euphorbia corollata*), and wild lupine (*Lupinus perennis*) are present in the burn treatment but at relatively low frequencies (Table 1). Blocked multi-response permutation procedure

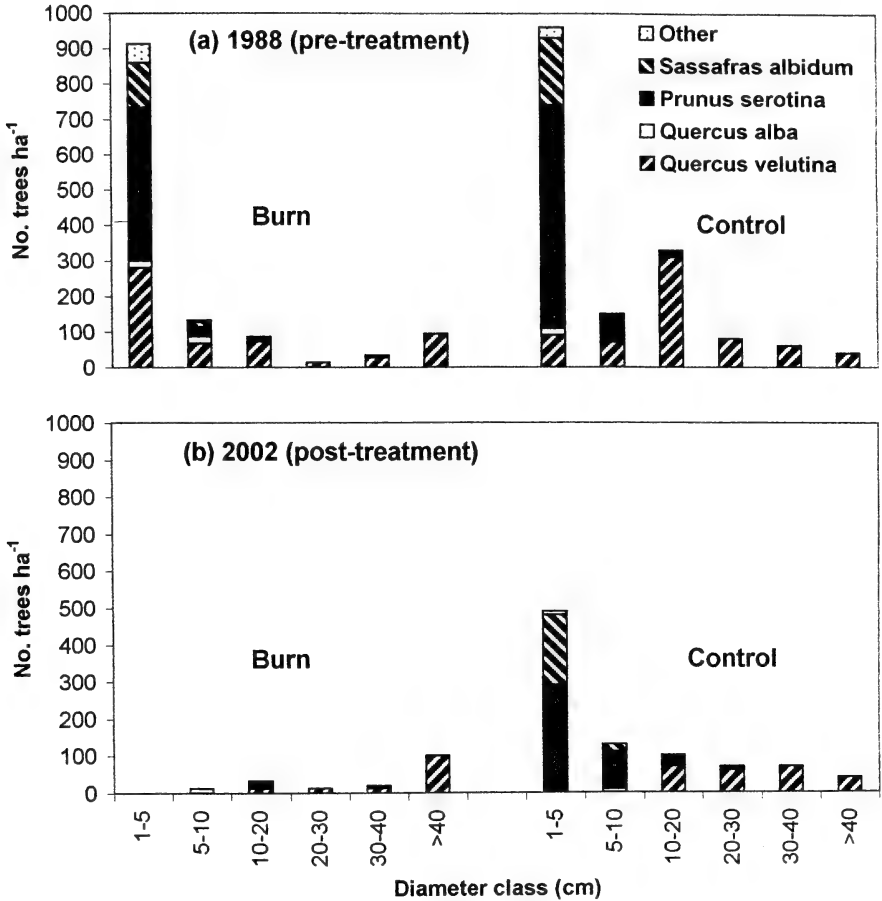


FIGURE 2. Pre- (1988) and post-treatment (2002) diameter distributions for burn and control treatments in Mary's Savanna, northwestern Ohio. Other species includes *Acer rubrum*, *Amelanchier arborea*, and *Pinus strobus*.

tests of pre- (1988) and post-treatment (2002) groundlayer composition within treatments indicated composition was weakly, but significantly different for both the burn ($T = -2.74$, $P = 0.02$) and control ($T = -2.62$, $P = 0.02$) treatments. However, causes for the compositional differences were disparate between treatments. Burn plots exhibited new occurrences or increases in percent cover of species requiring greater insolation such as wild lupine (33% plot occurrence increase and seven-fold increase in mean percent cover), while control plots exhibited decreases of species requiring greater insolation like hairy puccoon (*Lithospermum carolinense*; 100% plot occurrence reduction) and increases of woody vegetation such as sassafras (4% mean cover increase) tolerant of shade (Larch & Sakai 1985). Based on the relatively small blocked multi-response permutation procedure T -statistic (McCune & Mefford 1999), however, burn

(a) control



(b) burn

(c) burn
groundlayer

FIGURE 3. Post-treatment (2002) community structure of the control and burn treatments in Mary's Savanna, a 100-year-old black oak savanna in northwest Ohio. In the burn groundlayer (c), herbs requiring greater insolation such as *Baptisia tinctoria* (top center) and *Lupinus perennis* (bottom right) exhibited increases in cover during the 15-year experiment. (Photos by S. R. Abella, 12 June 2002).

TABLE 1. Mean percent frequency for fifteen 1-m² subplots per 0.05-ha plot in 2002 (post-treatment) of the most common plant species for burned (n = 3) and control (n = 2) plots in Mary's Savanna, northwest Ohio.

Growth form and species	Burn	Control
Seedlings	% Frequency (mean \pm SD)	
<i>Acer rubrum</i> —red maple	4 \pm 4	13 \pm 0
<i>Prunus serotina</i> —black cherry	20 \pm 18	33 \pm 9
<i>Quercus alba</i> —white oak	4 \pm 8	P [†]
<i>Q. velutina</i> —black oak	71 \pm 4	70 \pm 24
<i>Sassafras albidum</i> —sassafras	31 \pm 4	17 \pm 24
Shrubs		
<i>Gaylussacia baccata</i> —black huckleberry	9 \pm 15	23 \pm 14
<i>Rosa carolina</i> —pasture rose	27 \pm 27	27 \pm 9
<i>Rubus allegheniensis</i> —common blackberry	9 \pm 15	—
<i>R. flagellaris</i> —northern dewberry	16 \pm 17	3 \pm 5
<i>Rhus copallina</i> —winged sumac	2 \pm 4	—
<i>Vaccinium angustifolium</i> —low sweet blueberry	27 \pm 31	10 \pm 5
<i>V. pallidum</i> —hillside blueberry	58 \pm 10	30 \pm 14
Graminoids		
<i>Andropogon gerardii</i> —big bluestem	P	—
<i>Carex pensylvanica</i> —Pennsylvania sedge	100 \pm 0	97 \pm 5
<i>Panicum</i> spp.	9 \pm 10	10 \pm 5
Fern		
<i>Pteridium aquilinum</i> —bracken fern	93 \pm 7	100 \pm 0
Forbs		
<i>Asclepias tuberosa</i> —butterfly-weed	P	—
<i>Baptisia tinctoria</i> —false indigo	P	P
<i>Comandra umbellata</i> —bastard-toadflax	4 \pm 8	—
<i>Euphorbia corollata</i> —flowering spurge	13 \pm 18	P
<i>Helianthemum bicknellii</i> —frostweed	13 \pm 7	3 \pm 5
<i>Lithospermum carolinense</i> —hairy puccoon	2 \pm 4	—
<i>Lupinus perennis</i> —wild lupine	9 \pm 15	—
<i>Lysimachia quadrifolia</i> —whorled loosestrife	9 \pm 10	P
<i>Phlox subulata</i> —moss phlox	P	—
<i>Polygonatum biflorum</i> —Solomon's seal	7 \pm 7	3 \pm 5
<i>Potentilla simplex</i> —common cinquefoil	16 \pm 4	P
<i>Smilacina racemosa</i> —false Solomon's seal	P	P
<i>Tephrosia virginiana</i> —goat's rue	P	7 \pm 9
<i>Viola pedata</i> —birdfoot violet	P	—

[†] Species did not occur in a subplot but was present on a plot.

treatments have only subtly affected overall groundlayer composition of this savanna.

Groundlayer species richness per plot did not change significantly between pre- and post-treatment for either treatment (Fig. 4). Shannon's diversity index also did not differ between pre- and post-treatment for either the burn (2002 $H' = 1.96 \pm 0.28$; $t = 0.45$, $P = 0.70$) or the control (2002 $H' = 1.86 \pm 0.33$; $t = -0.23$,

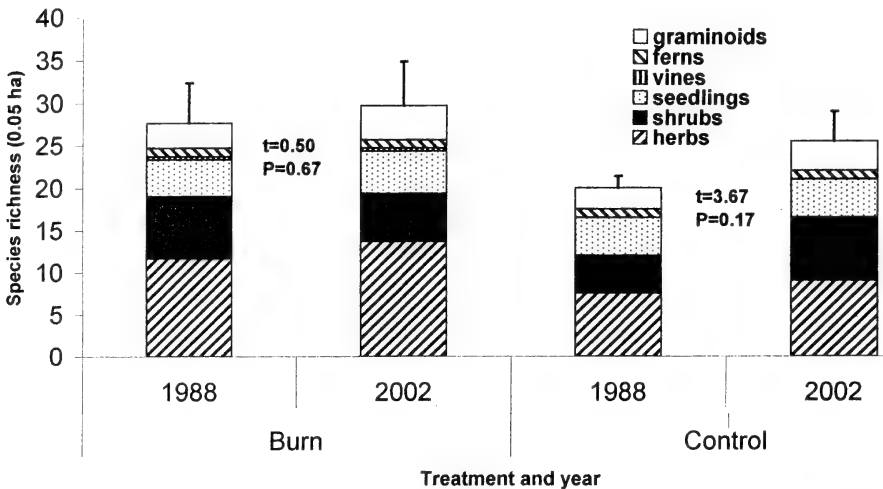


FIGURE 4. Mean species richness in 1988 (pre-treatment) and 2002 (post-treatment) for burn and control treatments in Mary's Savanna, northwestern Ohio. Error bars represent one standard deviation for total mean species richness, and t -statistics and probabilities represent year comparisons of means within treatments (two-tailed paired t -tests).

$P = 0.86$). No significant change in species diversity during the 15-year period associated with burn treatments in Mary's Savanna is consistent with the short-term (3-year) findings in other savannas without overstory reduction treatments in the Oak Openings region (Abella et al. 2001). These results suggest that the disturbance of burning alone is insufficient to significantly alter patterns of groundlayer diversity in Oak Openings savannas that had previously succeeded to closed-canopy forest as had Mary's Savanna.

Burn treatments reduced Oi horizon thickness by 4.7 cm, whereas thickness of the Oe+a horizon did not change significantly (Fig. 5). Many herbs of oak savannas, such as hairy puccoon, germinate and emerge most successfully on exposed mineral soil (Weller 1985). The relatively thick Oe+a horizon in Mary's Savanna may preclude the establishment of these savanna herbs (Facelli & Pickett 1991). Phillips et al. (2000) found that the Oe+a horizon remained 1.5 cm thick in a Tennessee oak stand after 35 years of burn treatments, and this study combined with our findings suggest that long-term burning in Mary's Savanna will not result in our hypothesized reduction in Oe+a horizon thickness. It is unclear if the 90-year period of fire suppression during which Mary's Savanna developed has resulted in an unusually thick Oe+a horizon not able to be readily reduced by burning, or if despite reductions in the Oi horizon annual inputs of plant litter exceeded levels consumed by the burn treatments.

During the 15-year duration of this study, some community characteristics of the burn treatment of Mary's Savanna have remained relatively constant, while other characteristics have changed considerably (Figure 6). Mean cover of bracken fern doubled to 25% in the first two growing seasons following the ini-

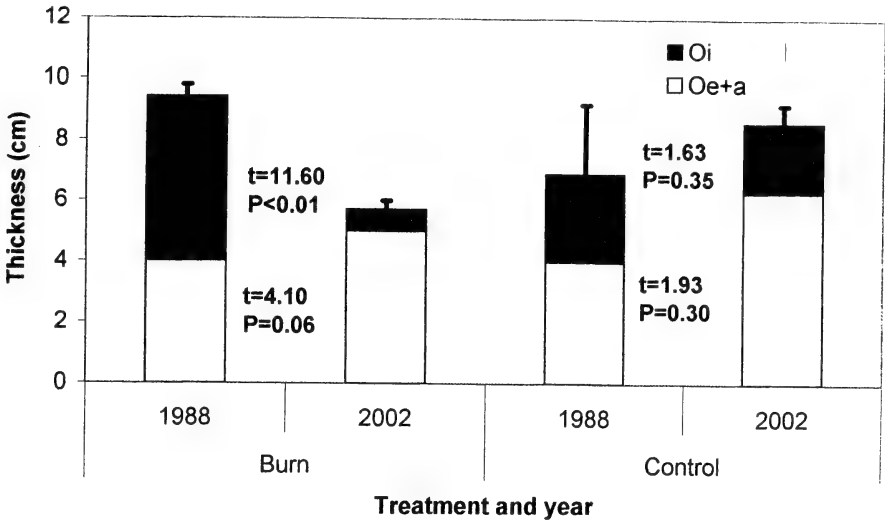


FIGURE 5. Mean Oi and Oe+a horizon thicknesses in 1988 (pre-treatment) and 2002 (post-treatment) for burn and control treatments in Mary's Savanna, northwestern Ohio. Error bars represent one standard deviation for total mean O-horizon thickness, and *t*-statistics and probabilities represent year comparisons of means within treatments for each of the Oi and Oe+a horizons (two-tailed paired *t*-tests).

tial 1988 burn treatment (Brewer & Grigore 1993), and then declined but remained above pre-treatment levels in 2002 (Fig. 6). Sapling density decreased sharply after the first burn treatment in 1988, recovered by 1993 after a four-year period without burning, and remained low for the rest of the study. In comparison, groundlayer species richness and overstory oak density varied little (Fig. 6). Results indicate that experimental burn treatments have differentially affected different community characteristics over the 15-year period, and demonstrate the utility of long-term permanent plot studies for directly detecting temporal changes of savanna vegetation.

Additional experimental treatments are needed to continue restoring historic vegetation composition and structure to Mary's Savanna (Brewer & Vankat 2001). Burn treatments could be continued at irregular intervals not more frequent than every two years to balance positive and negative effects of fire on different plant species (Grigore & Tramer 1996). Overstory oak density in Mary's Savanna presently is high (Fig. 2), and a reduction in density of 33–50% is necessary to approach the upper density of 43 trees ha⁻¹ documented for historical savannas in this region (Brewer & Vankat 2001). This density reduction could decrease the current average canopy cover of 55 ± 4% in the burn treatment, possibly alleviating light limitations for the establishment of such herbs as wild lupine (Grigore & Tramer 1996), while enhancing the diversity of sunny and shady microsites characteristic of oak savannas (Leach & Givnish 1999). Higher light levels may also decrease the current dominance of bracken fern, a species susceptible to killing frosts in more open savanna structures (Cody & Crompton

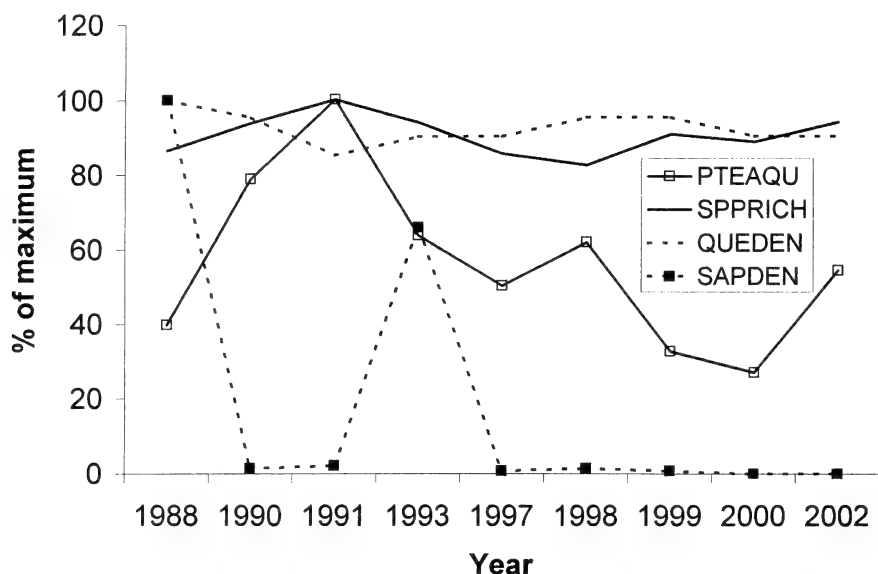


FIGURE 6. Community dynamics during a 15-year period for a burn treatment in Mary's Savanna, northwestern Ohio. Abbreviations and maximum mean values (in parenthesis) for variables are as follows: PTEAQU = *Pteridium aquilinum* % cover (31.9%), SPPRICH = species richness per 0.05 ha (32 species), QUEDEN = *Quercus* density greater than 30 cm diameter (133 trees ha⁻¹), and SAPDEN = total sapling density of all species in the 1–5 cm diameter class (913 trees ha⁻¹). Burn treatments were applied in 1988–1990, 1993–1994, 1997–1998, and 2001.

1975). Results of this study support the continuation of experimental plant community restoration treatments by the Toledo Metroparks, and indicate further research is needed to clarify long-term patterns of temporal change in oak savannas, once a dominant vegetation type of the midwestern landscape.

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THE BIG TREES OF MICHIGAN

36. *Syringa vulgaris* L. Common Lilac

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The largest known Common Lilac in Michigan is located near St. Ignace in Mackinac County near the eastern end of Michigan's Upper Peninsula. Several other very large lilacs occur on nearby Mackinac Island.

Description of the species: Although technically not a tree at all, when Common Lilacs become very old and reach heights of 30' (9.1 m), they will have a reduced number of main trunks and look more like trees than the shrubs from which they have grown. It has been decided, consequently, to include them and other large Michigan shrubs in this series without changing its title.

The Common Lilac belongs to the olive family, Oleaceae, along with *Forsythia*, *Fraxinus* (ashes), and *Ligustrum* (privets). Ashes are native forest trees. *Forsythia* is frequently planted for its bright yellow, early spring flowers, and *Ligustrum* is frequently planted for hedges.

The Common Lilac is present in Michigan in the form of many cultivars. It is easily recognized by its opposite leaves and cordate-ovate leaf blades, its shrubby habit when young, and its large panicles (10–20 cm. long) of aromatic tetramerous flowers (see Fig.1). The corolla is tubular and spreads into four lobes. The flowers are usually white, pink, lavender, or reddish-purple. It has widely escaped (or persisted) from cultivation throughout Michigan. It is a native of northeastern Europe.

Location of Michigan's Big Tree: The State Champion Common Lilac stands in front of a green and white house with a flagpole at 332 Pt. La Barbe Road. To reach the tree take the Mackinac Bridge (I-75) across the Straits of Mackinac to Michigan's Upper Peninsula. Soon after leaving the bridge go 2 miles on US 2 northwest away from St. Ignace. Turn left (south) on Pt. La Barbe road and proceed to #322.

Description of Michigan's Big Tree: The State Champion Common Lilac was measured by Charles Ulrich and Elwood B. Ehrle on 1 August 1998. The main trunk forks into several trunks at 4½' above the ground. The largest of the branch trunks has a girth of 65" (5'5" or 1.7 m) above 4½'. Smaller trunks have girths of 52" (4'4" or 1.3 m) and 35" (2'11" or 0.9 m). The "tree" is 30' high (9.1 m) and has an average crown spread of 29' (8.8 m). Other Common Lilacs, nearly as

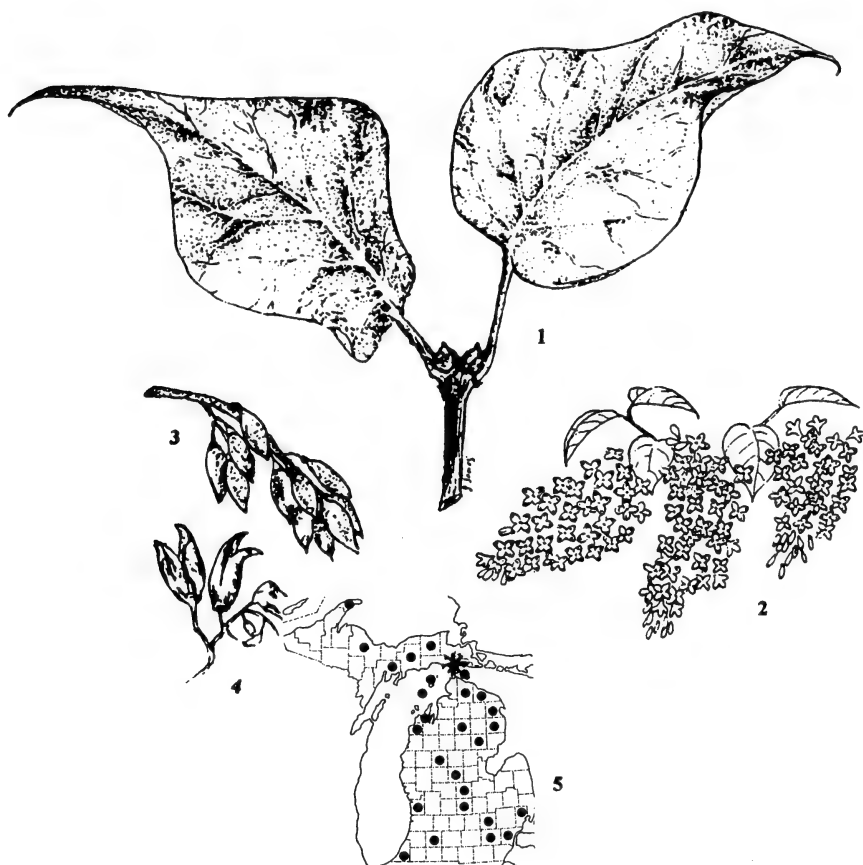


FIGURE 1. Documented distribution and characteristics of the Common Lilac. The map (5) is from Voss (1996). The asterisk indicates the location of Michigan's Big Tree. The illustrations are from original art prepared by Sara James in 1999. 1. Twig with buds and opposite leaves ($\times\frac{1}{4}$). 2. Panicles of tetramerous flowers ($\times\frac{1}{4}$). 3. Capsules ($\times 1$). 4. Capsules open ($\times 1$).

large, were measured on Mackinac Island. Table 1 compares six large Common Lilacs on Mackinac Island with the St. Ignace State Champion.

INVITATION TO PARTICIPATE

If you would like to join in extending this series of articles by visiting and describing one or more of Michigan's Champion trees, please contact Elwood B.

TABLE 1. Six Large Common Lilacs Measured in 1998 on Mackinac Island and Compared with the St. Ignace State Champion.

Big Tree Inventory #	Location	G (")	H (')	C.S. (')	Notes
426	Pt. La Barbe Rd, St. Ignace	65	30	29	State Champion.
427	Metivier Inn, Market St. west of Fort St.	49	25	31	2 main trunks. 1887 photo shows lilac in front.
428	Across from St. Anne's Church	59	25	31	1 main trunk, 1 smaller trunk.
429	French Lane near Market St., side yard.	50	25	40	3 main trunks.
868	Grand Ave., 2 doors N of Grand Cottage	35	27	30	2 main trunks.
869	Grand Ave., in front of Grand Cottage	52	28	37	4 main trunks. Former home of Wm. Backhouse Astor, built in 1819.
870	Harbor View Inn, Huron St., near Church St.	40	30	39	4 main trunks.

Ehrle for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property.

LITERATURE CITED

- Voss, E.G. 1996. Michigan Flora. Part III Dicots (Pyrolaceae-Compositae). Bulletin of the Cranbrook Institute of Science No. 61 and University of Michigan Herbarium, Ann Arbor, MI. xix + 622 pp.

THE BIG TREES AND SHRUBS OF MICHIGAN

37. *Diospyros virginiana* L. Persimmon

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The largest known Persimmon tree in Michigan is in the city of Grand Rapids in Kent County, in the southwest part of the Lower Peninsula.

Description of the species: Persimmon is a member of the mostly tropical family Ebenaceae. It is the only member of this family known to be growing in Michigan. The Persimmon ranges "from Connecticut and southeastern New York west to southeastern Iowa, south to southern Florida and eastern Texas" (Grimm 1983). From the range statement, it may be inferred that the persimmon trees which occur in Michigan are planted and are not naturally occurring populations. The tree can most readily be recognized by its yellowish or orange fruits which are about an inch in diameter (see Fig. 1), and are subtended by four persistent calyx lobes. The twigs lack a terminal bud and the lateral buds have only two bud scales showing. The leaves are simple, alternate, on pubescent petioles $\frac{1}{4}$ –1" long, with blades ovate, rounded at the base, 2–5" long and 1–2" wide.

Location of Michigan's Big Tree: The largest Persimmon in Michigan is located behind the house at 1716 North Center Avenue, in Grand Rapids. The site can be reached by taking the Ann Street exit (Exit #88) from U.S. 131 on the north side of Grand Rapids and heading east 0.6 mile to Center Avenue; turn right onto Center Avenue and go to #1716, a gray house with white trim at the time the tree was last measured. The GPS coordinates for the location are latitude N 42° 59.672' and longitude W 85° 40.051'. Thanks to Fred Nietering for help in locating this tree.

Description of Michigan's Big Tree: The tree has a single, solid, healthy trunk. Its girth at 4.5' above the ground was 95" when measured on 5 June 2003. The tree was 55' high and had an average crown spread of 45'. It was flowering at the time it was measured and is said to produce fruits prolifically in the fall. (As both 'possums and people know, the fruits only become sweet and edible after the first frost.)

INVITATION TO PARTICIPATE

If you would like to join in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B. Ehrle for help with locations, specifications for taking measurements, and assistance



Figure 1. The characteristics of Persimmon and the location of Michigan's Big Tree. The twig on the left shows flowers, while that on the right shows fruits. The drawings are approximately $\frac{1}{2}$ natural size, from Sargent (1965). The asterisk on the map shows the location of Michigan's biggest specimen.

with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property. For the most recent list of Michigan's Big Trees, see Ehrle (2003).

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THE BIG TREES AND SHRUBS OF MICHIGAN

38. *Catalpa bignonioides* Walter Southern Catalpa

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The largest known Southern Catalpa tree in Michigan occurs north of Grand Rapids in the city of Sparta, in Kent County in the southwest part of Michigan's Lower Peninsula.

Description of the Species: Catalpas belong to the family Bignoniaceae. As such they have showy white flowers which are borne in many-flowered panicles. The flowers are 2–6 cm across and are 5-lobed at their 2-lipped tips and tubular below (Fig. 1). From a distance they could be confused with the similar sized panicles and flowers of the Horse Chestnut tree which, however, is readily distinguished by its palmately compound leaves. The leaves of the catalpas are simple, opposite or whorled, large, heart-shaped, and have an acuminate apex. The leaves of the Southern Catalpa are smaller (10–20 cm) than those of the Northern Catalpa (20–30 cm). The flowers of the Southern Catalpa are also smaller (2–4 cm across) than those of the Northern Catalpa (4–6 cm across). The cylindrical fruiting capsules of the Southern Catalpa are about 1 cm in diameter. Those of the Northern Catalpa are larger, usually 1.5 cm in diameter. Both species retain their capsules throughout the winter. The seeds of the Southern Catalpa have pointed fringed wings at both ends. Those of the Northern Catalpa have wide fringed wings at both ends.

In southern Michigan, the Northern Catalpa is a common native species and the Southern Catalpa is quite rare as a cultivated species.

Location of Michigan's Big Tree: The largest known Southern Catalpa in Michigan is located behind the house at 101 Division St. in Sparta, MI. The tree can be reached by taking US Route 131 north through Grand Rapids. Continue north to exit 89 and take Michigan Route 37 (M-37) towards Newago. Turn right onto 13 Mile Road which becomes Division Street in Sparta. At 101 West Division Street, behind a yellow house, is the champion Southern Catalpa tree. The GPS coordinates for this location are N 43° 9.681' by W 85° 42.757'. Thanks to Fred Nietering for help in locating this tree.

Description of Michigan's Big Tree: The tree has a large brass plaque dated April 13, 1960 declaring that "This tree is a champ." The plaque was placed there by the Michigan Botanical Club. There is a large hollow place in the trunk. As measured on 5 June 2003, the girth was 195" (16' 3", diameter = 62"). The tree was 72' (22 m) high and had an average crown spread of 62' (18.9 m). The total points for this tree are $195 + 72 + \frac{1}{4}(62) = 283$.

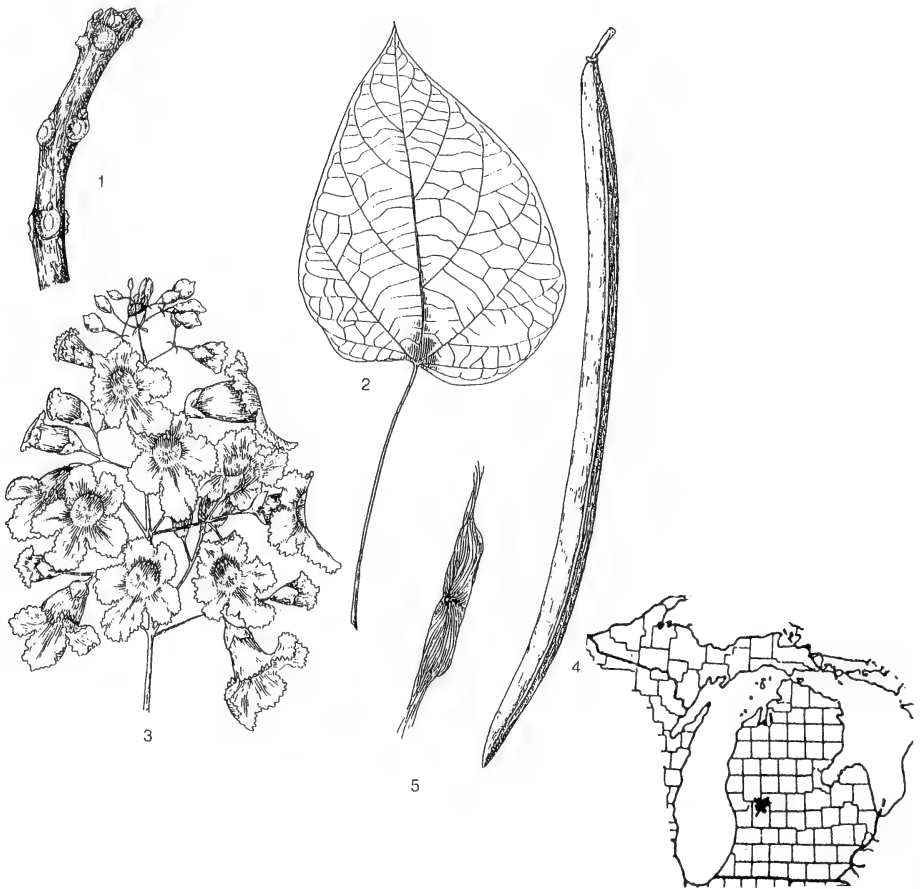


Figure 1. Characteristics of the Southern Catalpa and location of Michigan's Big Tree. The illustrations are from Barnes and Wagner (1981). The asterisk on the map shows the location of Michigan's Big Tree. 1. Winter twig, $\times 1$. 2. Leaf, $\times \frac{1}{2}$. 3. Panicle of flowers, $\times \frac{1}{2}$. 4. Fruit, capsule, $\times \frac{1}{2}$. Seed, $\times 1$.

INVITATION TO PARTICIPATE

If you would like to join in extending this series of articles by visiting and describing one or more of Michigan's Big Trees please contact Elwood B. Ehrle for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property. For the most recent list of Michigan's Big Trees see Ehrle (2003).

LITERATURE CITED

- Barnes, B. V. & W. H. Wagner Jr. 1981. *Michigan Trees. A guide to the Trees of Michigan and the Great Lakes Region*. University of Michigan Press, Ann Arbor. viii + 393 pp.
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REVIEW

Wofford, B. Eugene and Edward W. Chester. 2002. *Guide to the Trees, Shrubs, and Woody Vines of Tennessee*. University of Tennessee Press, Knoxville. Soft-cover, x + 286 pages, including 380 colored plates; ISBN 1-57233-205-0, \$29.95 at amazon.com.

As a graduate student at Vanderbilt University in Nashville, 1960-1964, I wanted to learn something of the Tennessee flora. There were precious few resources, I soon learned. We mostly used out-of-range manuals like the Britton & Brown *Illustrated Flora* and Gray's *Manual*, and they sufficed. I asked my professors about books on the Tennessee flora, and they acknowledged that some kind of typed checklist existed but otherwise there wasn't much. Gattinger's 1901 "The flora of Tennessee and a Philosophy of Botany . . ." was a historical oddity, which I never saw—it may well have been in the library, but I never bothered to look. In any case, floristic work was not encouraged, and we graduate students were more strongly encouraged to get on with our dissertation work, which mostly took the form of generic monographs.

There now exists a printed checklist of the Tennessee flora: Wofford & Kral, 1993, *Sida Botanical Miscellany* No. 10. And now, at long last, a truly scholarly work on an obvious segment of the flora of the state appears. It is not a large segment, comprising only 14.3% of the vascular plants, according to the Introduction.

Tennessee is not exactly within the purview of *The Michigan Botanist, a journal of Great Lakes botany*. Nonetheless, the book deserves attention here because it is such a fine model of how a botanical guide should be written. Moreover, the book appears to have been overlooked by reviewers, and that's a pity.

The Introduction is a generous 21 pages in length. Everything is explained and defined. (This is followed by an ample glossary, too.) The floristic provinces of the state are dealt with at length, and there's an outline map of the 95 counties of the state. As explained in the introduction, the illustrations cover nearly all the species and are mostly color photographs of flattened specimens, prior to drying. This is an innovation in botanical illustration, to my knowledge, and worthy of being copied by other authors.

The keys are very ample. They are divided into gymnosperms, monocots, and dicots — a logical separation that should pose no difficulties to anyone who'd pick up the book in the first place. Within each of these groups, the genera are arranged alphabetically. In the running heads, group names are on the verso, generic names are on the recto, so you can find *Decumaria* or *Salix* fairly quickly. In the body of the text, however, the family name is given first, even though the key and following treatment is not to families; this is a bit confusing and disconcerting, until you learn to ignore the family designation.

Surely in order to save space and weight, the authors offer no information on the distribution of a taxon outside of Tennessee, except for the introduced species, where the country or continent of origin is given. They do give at least one common name for every species, and these look fairly usual and sensible, even if some of them are little more than translations of the Latin. There are separate indexes to the common names and the scientific names.

The dedication in the front of the book is elegant: "To our families, our friends, field biologists, and fellow citizens of the state of Tennessee." This strikes me as entirely appropriate, because after all the authors have been "supported" by the taxpayers: Wofford at University of Tennessee, Knoxville, and Chester at Austin Peay State University, Clarksville. (Their institutional affiliations are not given on the title page; they are given on Cover 4.) Both have labored for many years, and now they are giving something back.

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Articles dealing with any phase of botany relating to the Great Lakes Region may be sent to the Editor at the address above. In preparing manuscripts, authors are requested to follow our style and suggestions in "Information for Authors," volume 28, p. 43; volume 29, p. 143, **except** please omit all abbreviations in titles of books and journals. Smaller contributions not involving illustrations may be submitted as e-mail attachments (indicate format, preferably WordPerfect, DOS or Windows) or incorporated into the body of an e-mail. Authors are urged to concern themselves with content, not formatting.

THE MICHIGAN BOTANICAL CLUB

Membership is open to anyone interested in its aims: conservation of all native plants; education of the public to appreciate and preserve plant life; sponsorship of research and publication on the plant life of the State and the Great Lakes area in general, both in the USA and in Canada; sponsorship of legislation to promote the preservation of Michigan's native flora; establishment of suitable sanctuaries and natural areas, and cooperation in programs concerned with the wise use and conservation of all natural resources and scenic features.

Dues are modest, but vary slightly among the chapters. "Chapters members" should contact the chapter presidents listed below. "Special Members" (not affiliated with a chapter) may send US\$17 to Alta Lahner, Special Membership Chair, 6088 Old Log Trail, Kalamazoo, MI 49009-9167; belaalta@aol.com. For both classes of membership, annual dues include a subscription to The Michigan Botanist. Address changes for Chapter Members should go to the Chapter President; address changes for Special Members should go to Alta Lahner.

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FLORA AND VEGETATION OF KALAMAZOO COUNTY, MICHIGAN

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Perennial lupine, *Lupinus perennis*, in remnant oak savanna along a railroad right-of-way in Portage Township, Kalamazoo County, Michigan.

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PURPOSE

This paper is intended to facilitate further study of the flora of Kalamazoo County by providing locally relevant data describing the habitat, distribution, abundance, and current status of native and introduced vascular plant species reported outside of cultivation in Kalamazoo County. I have used the Haneses' (1947) flora as a *vade mecum* of sorts, against which I have compared many of my observations in order to demonstrate how the flora has changed, and to help highlight the imminent conservation concerns that must be addressed to help maintain the ecological integrity (not persistence) of the native flora of Kalamazoo County and beyond. I have focused my efforts on native plants and plant communities that are now rare and/or poorly known in Kalamazoo County, because under current conditions many of those that persist will soon disappear.

PREFACE

Preparation of this flora started in the fall of 1994 while I was a sophomore undergraduate at Western Michigan University (WMU). I started with the intention of ascertaining the status of a handful of rare or otherwise interesting plants, especially orchids and carnivores, reported from Kalamazoo County by the Haneses (1947), but not since fully accounted for. The Haneses' (1947) flora of Kalamazoo County, and the (then) two volumes of the Michigan Flora (Voss 1985; 1972) became my constant companions in the field.

Over time, my interests and ambition grew to include prairie and savanna plants, and my field notebooks began to overflow with data and observations gathered during informal studies of the prairie and savanna flora of Kalamazoo County and beyond, the flora of the Sugarloaf Lakes region, a study of fen and bog floras, and so on. Eventually, in the interest of communicating my observations, and addressing what I saw as pressing conservation issues in the region, I embarked upon developing a checklist of the flora of Kalamazoo County, focusing especially on rare and otherwise noteworthy elements of the flora. By this time I was entering my final (fourth) year at WMU.

While considering offers for fall enrollment in graduate school I was offered a position at WMU co-teaching the field portion of plant taxonomy while Dr. Richard W. Pippen (the usual instructor) was away for the semester. At this time, Mike Penskar (Botanist, Michigan Natural Features Inventory (MNFI)) expressed interest in hiring me as an intern to help update the MNFI element occurrence (EO) records for rare or otherwise noteworthy plants, especially from SW Michigan. After considerable thought I decided to postpone graduate school for a semester and to further pursue my interests in the local flora and completion of the checklist while teaching plant taxonomy and interning at MNFI.

My slowly growing checklist of the flora of Kalamazoo County would turn out to be just the start however, as over the next few years, I gathered much additional data, especially from the remnant prairie, savanna, and wetland plant communities of Kalamazoo County, and I decided to expand the checklist to include an introduction, annotations for each species, and an overview of plant communities. Additional data were gathered from herbarium specimens, the notes and 1947 flora of Clarence R. and Florence N. Hanes, other published and unpublished florulas, countless personal communications, and personal experience with the flora in most sections of every township in Kalamazoo County. This expansion was made possible by frequent trips back to Kalamazoo County from the University of Illinois (where I was in graduate school) to visit my future wife at WMU. From 1998–1999 the flora continued to evolve, reaching its current form in approximately the spring of 2000 when Dr. Richard Brewer (WMU) was kind enough to read through and comment on an admittedly very rough draft of the manuscript. I continued to work on the manuscript periodically, but much work (including some field work) remained to be done to prepare the manuscript for publication. In June of 2000 I graduated with a master's degree in entomology from the University of Illinois, and moved to Harvard

University where I continued to work in spells on the manuscript until its completion in the spring of 2004.

My fascination with orchids and carnivorous plants started this journey, but over the last ten years of study I have become fascinated with the initially imposing grasses, sedges, pondweeds, hawthorns, brambles, and asters (many of which still perplex and command my attention). Clearly, a work like this is never finished, and doubtless, there are still numerous loose ends that remain. However, I am satisfied that my initial goal (to provide locally relevant data describing the habitat, distribution, and abundance of native and introduced vascular plant species known outside of cultivation in Kalamazoo County) has been accomplished. Due to other commitments I must leave what additional work remains to my successors.

ACKNOWLEDGMENTS

Many more people than can be mentioned here contributed in diverse ways to this flora. I must thank all of those who have commented on the manuscript, joined me in the field, examined specimens, and endured countless e-mail inquiries and phone calls, especially Richard Brewer (WMU), Michael R. Penskar (MNFI), Anton A. Reznicek (MICH), and Edward G. Voss (MICH). Completion of this flora was much facilitated by Dr. Edward G. Voss and the three volumes of the "Michigan Flora" that he so masterfully produced (Voss 1972, 1985, 1996). I could not have completed this book without his exhaustive keys, specimen database, and the countless annotations he made to herbarium specimens. I would also like to thank the countless property owners who generously allowed me access to their land.

Support in writing the manuscript came indirectly from Dr. Stephen B. Malcolm (WMU) and Dr. May R. Berenbaum (University of Illinois, Urbana-Champaign (U of I)) through their encouragement and tolerance of my forays into the Kalamazoo Flora and away from ongoing ecological and entomological writing and research for which I was employed. The WMU Lee Honors College helped pay for gasoline used on my near daily botanical expeditions during the summer of 1996. The Clarence R. and Florence N. Hanes fund, established at the bequest of Mrs. Hanes, provided support in 2002 to permit completion of herbarium studies, and to hire a short-term, part-time assistant to help with editorial details and with preparing the manuscript for publication. I am grateful to the trustees of the Hanes Fund and Mr. and Mrs. Hanes for providing me with this opportunity.

Special thanks are especially due to my wife, Katherine McKenna. Without her assistance, patience, and support, this flora surely would not have been completed. Katherine, it is to you that I dedicate this work.

INTRODUCTION

Landscape & Climate. Kalamazoo County covers approximately 576 sq. mi. and is composed of 16 townships, each approximately 36 mi. square (Figure 1). Rivers, streams, and 418 lakes and ponds greater than about one acre in size cover 3.2 % of the surface area. The largest lakes are Gull (1880 acres) and Austin (1050 acres). The Kalamazoo River traverses the county from near Augusta in the east to near Cooper in the north and is the largest waterway. Andrew's Creek, Augusta Creek, Bear Creek, Comstock Creek, Gourdneck Creek, the Gull Lake Outlet, Little Portage Creek, Portage Creek, the Portage River, Sand Creek, and Spring Brook are important smaller waterways. The land sur-

face consists of end moraines, till, and outwash, resulting from several major periods of continental glaciation, most recently the Cary substage of the Wisconsin glaciation (ca. 16,000 to 13,500 years ago). Glacial till occupies about 10% of the surface area and is confined to the SE quarter of the county. Outwash sediments, mainly sand, gravel, and some alluvium deposited by preglacial streams, occupy more than half of the surface area and are an important component of the landscape throughout the county. Lacustrine sand, silt, and clay deposited in the ancient lakes Alamo and Kalamazoo cover less than a fourth of the land surface. Shale bedrock underlies all of these deposits and is closest to the surface at the east edge of the county. The growing season in Kalamazoo County varies from approximately 145–155 days. Average annual precipitation varies only slightly from NE to SW (more in the SW), and averages approximately 89 cm./yr. (Dorr & Eschman 1971; Kalamazoo County Surveyor pers. comm. 2000).

Human History & Vegetation Patterns. The Potawatomi were the most recent Native Americans to occupy the area that would eventually become Kalamazoo County. They engaged in some agriculture, but were primarily hunter-gatherers. Through their use of fire, they played a significant role in the development and maintenance of the prairie and savanna flora of the region.

The first white trappers and traders entered the region in the 17th century. The celebrated French explorer, Rene Robert Cavelier, Sieur de La Salle, traveled east through the county passing through sugar maple forests, open woodlands, oak savannas, and prairies en route to Niagara in 1680 (Woodruff 1999). His correspondence provides the earliest documentation of the former prairie and savanna landscape of Kalamazoo County. Between 1826 and 1830, the area that would become Kalamazoo County was surveyed by employees of the federal government's General Land Office (GLO) (Voss 1978; Hodler et al. 1981; Comer et al. 1995). At this time Native American population density in Kalamazoo County was among the highest in Michigan. Most Native American settlements were then located on or near terrestrial prairies (Cremin & DeFant 1987; Cremin & Quattrin 1987; Fitting 1975; Stoneman 1982; Tanner 1987). The plat maps and field notes from the GLO surveys of the region provide perhaps the best available record of the native landscape of Kalamazoo County (Comer et al. 1997). Our current native flora is largely a vestige of this former landscape.

The first European settlers arrived in the area that would become Kalamazoo County by the late 1820s. Kalamazoo County was organized by an act of the territorial legislature and approved on 30 July 1830. By this time settlement was in full swing. In 1840, following the terms of the 1833 Treaty of Chicago, most remaining Native Americans were assembled at what would become the Michigan Central Station in the city of Kalamazoo and were taken away to reservations. The fate of the native landscape, flora, and fauna of Kalamazoo County was sealed.

History of Botanical Exploration. Kalamazoo County has a rich tradition of botanical exploration. Few areas in the upper Midwest have been so thoroughly botanized and can boast such a species-rich and relatively well-documented flora. The first official report on the plant life of Kalamazoo County came in

1837–1838 from a botanical survey of the two southern tiers of counties in Michigan as part of the Michigan Geological Survey, all under the direction of Douglass Houghton (see Appendix I) (McVaugh 1970). In 1876, Frank H. Tuthill of Kalamazoo published a paper in “The Botanical Gazette,” reporting on plants he collected beginning in June 1870, mostly in the vicinity of the city of Kalamazoo (Tuthill 1876). An amateur botanist, Austin Churchill Roberts (A. C. Roberts) also collected plants at this time (from about 1870 to 1905), primarily within a couple hours’ walking distance, mostly north of the city of Kalamazoo. Around the turn of the 20th century, numerous other collectors, including Oliver A. Farwell, Leslie A. Kenoyer, Charles F. Wheeler, and William J. Beal botanized in the area and otherwise contributed to the growing body of knowledge concerning the Kalamazoo County flora.

However, it was the botanical explorations of the amateur botanists Clarence R. Hanes and Florence N. Hanes of Schoolcraft that helped make the Kalamazoo County flora one of the best known in the country at that time (see Pitcher 1994). Their “Flora of Kalamazoo County Michigan, Vascular Plants,” published in 1947, reported on 1749 species, varieties, and forms of plants found in Kalamazoo County, based almost entirely upon their extensive personal herbarium, started in 1933. According to Voss (1963), “this book is the finest local flora of its type for any region in the Upper Great Lakes area. . . .” Several contemporaries of the Haneses regularly contributed to their botanical work and herbarium collection. Among the most significant was Frederick W. Rapp (Vicksburg). Rapp was an especially prolific collector. Several thousand of his specimens are housed at the WMU Hanes herbarium (see Appendix II).

Over the last 50 years, the Haneses’ (1947) “Flora of Kalamazoo County, Michigan Vascular Plants” has figured prominently in the study of the Michigan flora and beyond. As such, it seems appropriate to present here an overview of the Haneses’ botanical endeavors in Kalamazoo County. Perhaps the best overview is provided by the Haneses themselves. The following excerpts are from a red, leather-bound journal (at WMU) in which the Haneses provide an introduction and guide to their herbarium collection including a chronology and some background describing their floristic work. The entire journal appears to have been written by Clarence over a period of several years. It bears the title “Background of the herbarium and flora.”

“In 1891 while [I was] in High School a herbarium of about 80 specimens was made. A part of these were of garden trees and plants. Also Mrs. Hanes made a herbarium while in High School. This dealt more with the uncultivated plants and contained some quite uncommon species such as Arethusa bulbosa and the Dwarf Flowering Dogwood. . . . At the University, instead of continuing in a line of work that might have been more congenial, language, history, and economics were the subjects taken. About 1905-1910 the ferns and orchids of the Sugarloaf Lake Region were studied quite thoroughly and a collection was made at that time of the ferns. Orchids were not collected, but several varieties were carried to Mrs. Hanes’ mother while I was getting acquainted with my future wife. Probably this accounts for the fine teamwork that has produced the present herbarium.

We know now three to four hundred plants but had only herbarium specimens

of the ferns and part of the shrubs and trees. Our interest continued in our flora but it was not until the spring of 1933 that we seriously decided to get a permanent record of the plant life within a radius of five miles of Schoolcraft.

The Depression had come and our losses were quite serious. . . . We decided that it would be far better to take up a line of work that would be valuable to us in keeping our minds occupied and might also add something of value to the knowledge of the flora of our county and state.

Had we known the immense amount of labor required to produce the herbarium, we might have hesitated to start such an undertaking. . . . We had never seen a large herbarium and had no access to one, so our classification depended upon grubbing out for ourselves from either Gray's manual or Britton and Brown's flora, the correct place each plant should occupy. It is not meant by this that we did not have outside help. Lately we have had many of the more difficult genera checked and often determined by specialists in these groups. This aid has usually been freely and generously given.

In the spring of 1933 we were familiar with only a few scientific names. Also the technical descriptive terms were strange and new. The difference between grasses and sedges was vaguely understood. . . . From the start we made a practice of collecting everything that we considered different from what we already had. . . . During the winter months when there was more leisure, we profited by this habit. . . . Some of our rare or infrequent plants have been added because of this proclivity. . . .

During 1933 most of the collecting was done not more than five mi. from Schoolcraft. The means of transportation was a bicycle, so Mrs. Hanes only accompanied when the trip was on foot. A Ford pickup was given us in the fall of 1933 and from that time it has been "Botanizing with Lizzie". . . . Since possession of this car we have widened our territory to include all of Kalamazoo County. So far, January 1937, we have visited only a portion of the lakes, streams, woods and other collecting grounds. Rarely do we go to new territory or return to an old collecting field without discovering something new about the plants we have already collected.

At one time we had hoped to be able to pay part of our expenses through the knowledge of the flora of the county, but to the present we have never received a cent from this source. We have, however, taken much pleasure in this work and no years have been happier than the last four which have been given so intensively to bringing into the herbarium about 1400 species and varieties of the flora of Kalamazoo County.

During the two years since the above was written, our herbarium has been increased by the addition of almost two hundred specimens. These are all from Kalamazoo County. During our six years of intensive botany work, we have added some thirty plants to the records of the flora of Michigan besides finding range extensions for many more. These have been reported in *Rhodora* or in papers before the Michigan Academy of Sciences, Arts, and Letters.

The manuscript for a *Flora of Kalamazoo County* has been written. At first this was somewhat incomplete as the stations cited for specimens were naturally those nearest to our home, but now with more extended trips the flora has become representative of the county as a whole. No means of publication is in sight

at present. Such a flora is of value for no county of the state has been as intensively botanized as that of Kalamazoo. Also such a flora would help materially in the preparation of a flora of the state.

. . . At the beginning of this year of 1939, we are trying to arouse some enthusiasm in Michigan plant life in the Department of Conservation. At least our initial efforts have been met with some encouragement.

March 31, 1947 During the time since 1939, when the last entry was made here, we have continued our collections and studies until we have now in the herbarium 1749 different species, varieties, and forms. It was during these years between 1939 and 1947 that we did some of our most important work in botany. This was with the genus *Rubus*, the blackberry clan. With the aid of F. W. Rapp of Vicksburg about 22 new species of *Rubus* have been found in the county.

The flora meanwhile was revised, and added to yearly. Still there was no clear idea how it ever would get into book form. At least we were satisfied that if it ever did the expense must be borne by ourselves. Twelve dollars received from talks on the county flora over a period of 14 years was the nest egg. Fees, as executor of a rather large estate, made things look brighter, so it seemed feasible to try to get our book printed. In August of 1945 specifications were submitted to us. For 500 copies of a book of 192 pages we were to pay \$1240.00 and \$4.50 a page thereafter. This proposition fell through because of a lack of help but later the company offered to farm out the typing and also increased the price about 20 percent.

Not satisfied with this arrangement we finally made our contract with the Southworth-Anthoensen Press of Portland, Maine. This contract was for \$1200.00 for 500 copies of a 60-page book, and \$4.25 for each additional page. When finally published, the flora had 12 pages of introduction, and 295 pages of text and index.

The fourteen new species of blackberries are a distinctive feature of the flora. These were described for us by Liberty Hyde Bailey, who also loaned us the plates made from drawings by Florence Mekeel.

Finally dreams were realized for on February 28, 1947 six copies of our book arrived by mail. We now saw 14 years of study and pleasure brought into a permanent form. The volume is a beautiful example of the bookmaking art. Paper and binding are good; the printing is excellent; the blackberry drawings stand out distinctly. There are errors—some of ours and some of the printers.

The flora is the type of book that has little appeal to the public of the present day, but we have been pleased with its reception in Schoolcraft, our hometown. The letters and opinions of botanists throughout the United States have been very favorable. We have appreciated this for it is to specialists in the field of plant study that we must look for the final judgment of our work.

There have been several fine reviews of the flora, all unsolicited. These have been by Prof. M. L. Fernald in *Rhodora*, by Wm. B. Drew in *Ecology*, by ex-governor Chase S. Osborne in the *Sault St. Marie Evening News*, by Edgar Anderson in the *American Midland Naturalist*, by Ray G. Freisner in the *Journal of the New York Botanical Garden*, and by Henry T. Darlington in *Michigan History Magazine*."

Many others have been involved with floristics and plant ecology in Kalama-

zoo County, especially over the last 40 years. It is not possible to list them all, or their contributions here. The diversity and scope of their work has not only enriched our understanding of the regional flora and natural history, but has also provided me with substantial supporting information for use in writing this flora.

METHODS

Overview. This floristic survey of Kalamazoo County is based primarily on the results of field surveys and herbarium studies conducted by the author beginning in September 1994 and continuing through September 2003. My field surveys were guided primarily by the notes, publications, and herbarium specimens of the late Clarence Robert Hanes (1874–1956) and Florence Nutten Hanes (1886–1966) (Hanes & Hanes 1947). In addition to known field sites, new sites were sought for rare and otherwise noteworthy plants and plant communities. These are treated in relatively more detail in this flora than plants and plant communities that are mostly better known.

The SW quarter of the county in the vicinity of Schoolcraft received the best coverage in my field surveys as it did in those of the Haneses. Studying many of the same sites permitted me to evaluate how the flora has changed over the years.

The Kalamazoo County flora is well documented in herbaria. For this reason, and because time and resources were not generally available to prepare and/or maintain dried specimens, collections were generally not made. Instead, photographs were often taken, and limited collections were made only to help identify problematic taxa (and then usually discarded) and to document plants previously unreported from the county. The few specimens that were maintained are deposited at WMU and MICH.

During preparation of this flora I have examined all herbarium specimens collected from Kalamazoo County that are housed at WMU (including unmounted material from the collections of F. W. Rapp, L. A. Kenoyer, and others), and all specimens (including those collected by A. C. Roberts) housed at the Kalamazoo Valley Museum (KVM). Some specimens have been examined or otherwise documented from MICH, MSC, ALBC, BLH, GH, ILL, NY, and TEX. I have not examined the F. W. Rapp specimens at the Kalamazoo Nature Center (they were brought to my attention after completion of herbarium studies), and I have only examined a few select specimens from the Kellogg Biological Station Herbarium (KBSMS). Though I have made no formal count, many more than 5,000 herbarium specimens have been evaluated in preparing this flora. Sources for reports of plants that are not included in the Haneses' flora are indicated unless they are based on specimens at WMU, in which case no further information is generally provided. Herbaria are referred to in the text by their accepted abbreviations. Specimen numbers are not usually provided.

Collector(s) and other specimen label data are occasionally provided for noteworthy collections in the text of the annotated checklist. Annotations made by specialists familiar with the Michigan flora (especially A. A. Reznicek (grasses

and sedges), E. G. Voss (all taxa), H. E. Ballard (violets), and W. H. Wagner, Jr. (ferns and allies) were sometimes accepted as given when the identification of a specimen was not clear to me.

Most commentary refers to observations made by the author in the field in Kalamazoo County. Observations drawn from herbarium specimens, specimen label data, and/or other sources, are generally cited as such or otherwise indicated.

Family names and order in the list follow Voss (1972, 1985, 1996). Family names used by the Haneses are provided in parentheses. Genera are listed alphabetically within families, and species are listed alphabetically within genera, to facilitate browsing by those unfamiliar with other potential arrangements.

Common names are used in the text only rarely, and usually just for woody dominants. In most other cases, scientific names are used to avoid ambiguity. Common names in the annotated checklist are mostly from Voss (1972, 1985, 1996). Common names from Hanes & Hanes (1947) are sometimes given when they are not provided in Voss (1972, 1985, 1996).

For scientific names of Monocots (except Orchidaceae) and Dicots, I have followed Voss (1972, 1985, 1996). For the Orchidaceae I have followed Case (1987) (with a few exceptions), and for Pteridophytes and allies I have followed *Flora of North America Volume II* (1993). Other references have been consulted from time to time to clarify various taxonomic and ecological issues. Among these references are Barnes & Wagner 1981; Billington 1952; Billington 1949; Braun 1967; Cochrane et al. 1984; Cole 1901; Cooperrider 1995; Darlington 1945; Deam 1940; Eddy 1996; Fassett 1976; Hagenah 1955; Hanes 1938, 1939, 1940, 1941, 1942, 1943, 1945a and 1945b, 1947, 1950; Lellinger 1985; Musselman et al. 1971; Reznicek & Catling 1989; Rill 1983; Swink & Wilhelm 1994; University of Wisconsin Herbarium [Web Page] accessed January–April 2003; Wheeler & Smith 1881.

I have tried to include the Latin binomials used by the Haneses (1947) in the annotated checklist to facilitate cross-referencing. This was not always possible due to the many sub-specific taxa recognized by the Haneses, difficulty finding specimens in the herbarium that served as the basis for the Haneses' reports, and because there have been many changes in nomenclature since the publication of the Haneses' flora. Occasional mention is made of unusual forms; however, I have not generally recognized sub-specific taxa. I have included treatments in the annotated checklist for some widely recognized hybrids in the same format as for species (after Voss 1972, 1985, 1996). Treatments of lesser-known hybrids are included in the treatment for one of their presumed parents (whichever comes first alphabetically), regardless of their fertility. I have only reported some of the better-known hybrids, and especially those in Voss (1972, 1985, 1996). Authors are not provided for named hybrids. Taxa that are recognized in the annotated checklist, but not in the Michigan Flora (Voss 1972, 1985, 1996) and a few other minor taxonomic differences, are generally indicated where appropriate in the text.

Keys from *Flora of North America Volume II* (1993) can be used for ferns and allies, keys in Case (1987) can be used for most Orchidaceae, and the excellent keys in Voss (1972, 1985, 1996) can be used for most other taxa.

This flora does not usually provide specific locality data, especially for rare plants and orchids, to reduce the potential for exploitation, and because these data are mostly available elsewhere.

I have included references in the annotated checklist to relevant publications that may be of interest to the reader. Unpublished papers, reports, or manuscripts are also cited insofar as I am aware of them.

Frequency & Distribution. The estimated frequency, distribution, and habitat (typical plant communities) for most plant species reported from Kalamazoo County are given in the annotated checklist. Estimates are based primarily upon observations made by the author between September 1994 and September 2003, but data from herbarium specimens, and other reports made after 1 January 1990 have also been considered. Frequency is described as very rare, rare, occasional, or common, and refers to stems, not plants for species in which the distinction is not easily made. These descriptors have been applied subjectively, but I have made an effort to apply these and subsequent terms as consistently as possible. Distribution is described for each species in the annotated checklist as “through-out” the county, or restricted to specified regions and/or habitats. These descriptors should be considered my subjective interpretation of the aforementioned data.

Current Status. Plants designated “Extinct” have not been found at all previously known sites and new sites have not been located despite extensive searches. None of these species have been collected since publication of the Haneses’ flora in 1947, or they have been demonstrably extirpated from all known sites since then. For these species it is unlikely that extant sites will be located in Kalamazoo County (barring the unlikely event that they recolonize from outside of the county). I have used this designation only for species that I strongly believe to be extinct, and qualify the commentary when necessary. I have reserved this term for plants that are/were likely native (e.g., I have listed *Echinacea purpurea* as extinct since native plants are not known to persist; however, plants still occur throughout in waste places, but are generally thought to originate from cultivated, non-native specimens). Non-native species that no longer occur in Kalamazoo County are designated “No longer known.”

The label “Current status uncertain” is applied to plants for which data (post 1 January 1990 herbarium specimens, observations in the field, etc.) are not sufficient to assess contemporary distribution and abundance. This designation includes plants for which no extant sites are known despite some effort (but not exhaustive effort) to relocate them. Naturally occurring populations of these species may still remain unreported or undiscovered in Kalamazoo County. I have often altered this designation to read “Current status uncertain, very rare if still extant,” when some data (but not conclusive data) are available to suggest that a plant is no longer extant, or if it is extant, it must be very rare.

Plants for which no extant sites are known, and for which little or no effort has been made to locate extant sites are designated “Current status unknown.” Some species given this designation, and a few species designated “Current status uncertain” are not necessarily rare (although many clearly are), but may be

unfamiliar or only vaguely familiar to me. This is especially true of some of the grasses, sedges, pondweeds, and hawthorns. Relatively recent collections or observations of these species are lacking or otherwise insufficient to estimate current status.

Habitat descriptions are given using the community types characterized in Appendix III. When published or personally communicated observations have contributed significantly to the treatment of a species, I have cited their source. When not otherwise specified, observations made by the Haneses refer to their 1947 flora.

Plant Communities. Most plants in Kalamazoo County still occur in one or more discrete plant communities (here defined as an assemblage of plant populations in a given habitat with characteristic growth form, structure, seasonality, dynamics, and composition). Each species account in the annotated checklist includes the abbreviation(s) for plant communities in which the plant is/was likely to be found (Table 1 & Appendix III). When a plant is associated with an anthropogenic feature of the landscape, a more general "location" may be given such as "old fields," "roadsides," or "RR rights-of-way." Unless otherwise specified, reported habitats are based on my interpretation of herbarium specimen label data, and my field experience in Kalamazoo County and beyond. Often,

TABLE 1. Kalamazoo County Plant Communities recognized in the Annotated Checklist of Vascular Plants.

Aquatic/Wetland

Open Aquatic/Wetland

Submergent Marsh (SUB-MARSH)

Emergent Marsh (EM-MARSH)

Coastal Plain Marsh (COASTAL-PLAIN-MARSH)

Wet Meadow (WET-MEADOW)

Bog (BOG)

Fen (FEN)

Wet Prairie (WET-PRAIRIE)

Shrub Dominated Wetland

Inundated Shrub Swamp (SHRUB-SWAMP)

Shrub-Carr (SHRUB-CARR)

Forested Wetland

Tamarack Swamp Forest (TAMARACK-SWAMP)

Red Maple Swamp Forest (RED-MAPLE-SWAMP)

Black Ash Swamp Forest (ASH-SWAMP)

Mixed Hardwood Swamp Forest (HARDWOOD-SWAMP)

Floodplain Forest (FLOODPLAIN-FOREST)

Terrestrial

Terrestrial Prairie (TERRESTRIAL-PRAIRIE)

Terrestrial Shrub/Savanna

Black Oak Barren (BLACK-OAK-BARREN)

Bur Oak Savanna (BUR-OAK-SAVANNA)

White Oak Savanna (WHITE-OAK-SAVANNA)

Terrestrial Forest

Sugar Maple Forest (SUGAR-MAPLE-FOREST)

Oak Hardwood Forest (OAK-HARDWOOD-FOREST)

only the plant communit(ies) in which a specific plant is most likely to be found are reported (except for prairie and savanna inhabitants, and rare or otherwise unusual plants, for which I have tried to provide more comprehensive habitat lists). When recent specimens or observations are limited or lacking, I have still tried to provide a best estimate of frequency, distribution, and habitat (indicated by a "?"). I have made an effort to apply these descriptors as consistently as possible. However, they should be considered my subjective interpretation of the available data.

I occasionally use the terms remnant and relict to describe Kalamazoo County plant communities. Remnants are defined as portions of once more extensive plant communities. Relicts are usually considered to be plants or other natural features that persist despite the complete or nearly complete loss of the plant community in which they once occurred. Most of the time these terms are inferred since nothing but remnants and relicts remain of most Kalamazoo County plant communities.

When disturbed remnants of a plant community serve as the "location" for a species, this community is listed in the annotated checklist without qualification despite its likely present deviation (sometimes significant) from pre-European settlement conditions. For example, some communities such as terrestrial prairies are represented only by relictual populations of the plants they once supported. Others, such as black oak barren, bur oak savanna, and white oak savanna, are represented by overgrown (e.g., fire suppressed) or otherwise altered remnants that retain few characteristics of their pre-European settlement namesakes. I continue to use the names of these nearly extinct plant communities to describe the remnants that persist despite their often conspicuous deviations from the presumed pre-European settlement state. In Appendix III I have included an overview of the current and former plant communities of Kalamazoo County.

Kalamazoo County plant communities vary continuously along numerous ecological gradients such that the names and descriptions used in this flora should be viewed as a means of facilitating their identification and study, rather than definitive classifications. I have used the terms wet, wet-mesic, mesic, dry-mesic, and dry rather subjectively to describe the position of various features of plant communities along a moisture continuum from wet to dry. These terms are more often used to describe prairies, savannas, and oak forests than other plant communities.

Native vs. Non-native Plants. Species that are known to be introduced, partly native and partly introduced, questionably native, escapes from cultivation, naturalized weeds, rare waifs, or otherwise a component of the flora outside of cultivation, are often indicated as such in the annotated checklist. Non-native plants whose status outside of cultivation is uncertain, including exotic species that have not been seen in Kalamazoo County in many years, are listed because they may one day be rediscovered growing outside of cultivation. I have used my best judgment in deciding which records should be accepted. When possible I have indicated the status of non-native plants as one of the following (after http://www.dnr.state.wi.us/org/land/er/invasive_species.html accessed 2/03).

- **Adventive:** established from a native source but not likely a long-persistent component of the local flora
- **Locally established:** local outside of cultivation.
- **Widely established:** widespread throughout outside of cultivation.
- **Rarely escaped:** only rarely encountered outside of cultivation. When found, usually only one or a few plants are encountered.
- **Range change/extension:** once only known outside of Kalamazoo County, but now apparently resident.

Native plants are those that are assumed to have occurred in Kalamazoo County before widespread European settlement. I have used Voss (1972, 1985, 1996), and my own judgment in determining the status of questionable species.

THE FLORA OF KALAMAZOO COUNTY

Synopsis. This flora covers 1612 plant species and 39 hybrids known from outside of cultivation in Kalamazoo County. Of these 1651 taxa, more than 400 are non-native or partly introduced. The most species-rich genus in Kalamazoo County is *Carex*. More species of *Carex* (111) have been collected in Kalamazoo County than from any other county in Michigan. Other species-rich genera include *Aster* (19), *Panicum* (24), *Polygonum* (18), *Potamogeton* (20), *Salix* (18), *Solidago* (17), and *Viola* (19). The annotated checklist includes 133 species that were not reported in the Haneses' flora (1947). These species include new introductions to the flora (including adventives, range changes, etc.), presumed native species not before documented, and additions due to changes in taxonomy and previous misidentification. Several species reported by the Haneses (1947) have been excluded from this flora due to changes in taxonomy, previous misidentification, and lack of extant documentation.

Rare Species. Kalamazoo County has more plants listed as Extinct, Endangered, Threatened, or Special Concern by the state of Michigan than any other county in Michigan (Table 2) (Michigan Natural Features Inventory [Web Page] accessed 5/04). These plants are mostly restricted to prairie, oak savanna, and wetland plant communities, and many are already extinct in Kalamazoo County (Tables 2 & 3). Some rare species are (or were) here at the edge of their known distributions, or are geographically disjunct from other known populations (Barnes 1993; Wagner et al. 1977). Many species in addition to those listed as Extinct, Endangered, Threatened, or Special Concern by the state of Michigan, are very rare, extinct, or potentially extinct in Kalamazoo County (Tables 3–5).

Several species are known in Michigan only from Kalamazoo County. Among these rarities (not all still extant, and some perhaps adventive) are: *Aristida dichotoma*, *Aster paternus*, *Carex aggregata*, *Carex leavenworthii*, *Carex mesochorea*, *Carex retroflexa*, *Carex straminea*, *Cuscuta pentagona*, *Glyceria acutiflora*, *Lemna valdiviana*, *Liatris punctata*, *Lygodium palmatum*, *Panicum calliphyllum*, and *Porteranthus trifolius*.

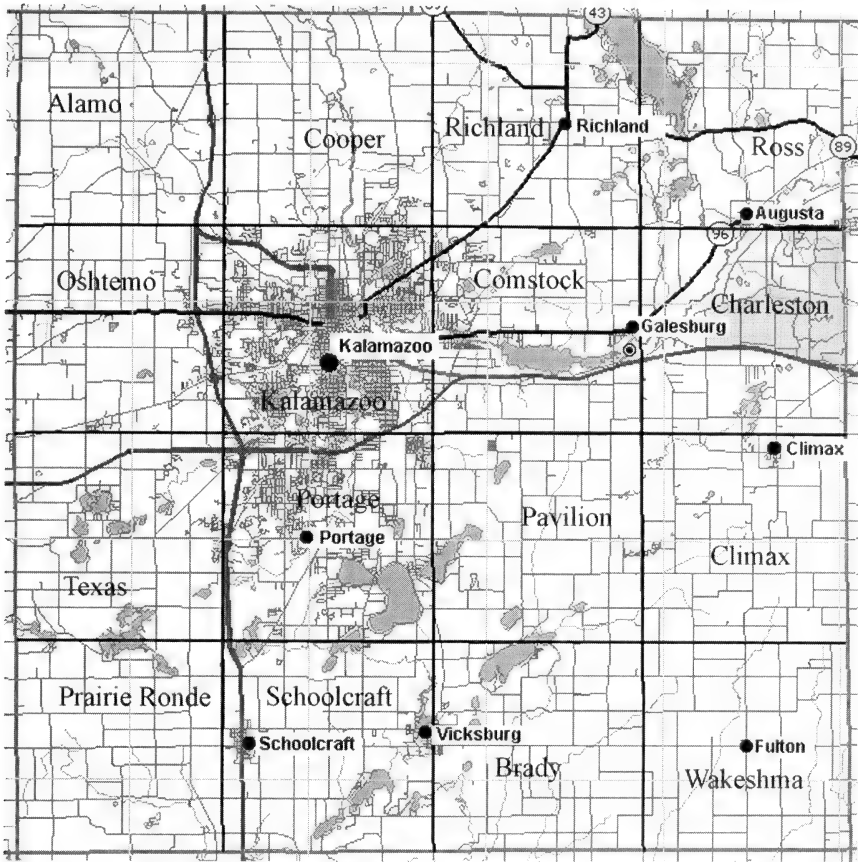


FIGURE 1. Political map of Kalamazoo County including townships, major roads, cities, and towns.

Excluded Species. An incomplete list of species reported in the literature as occurring outside of cultivation in Kalamazoo County, but for which no specimens or other significant documentation are known, is presented in Table 6. These species are not listed in the annotated checklist.

Phytogeography. Rare or otherwise unusual plants that mostly occur north of Kalamazoo County include *Arctostaphylos uva-ursi*, *Cornus canadensis*, *Diervilla lonicera*, *Eriophorum tenellum*, *Gaultheria hispidula*, *Hippuris vulgaris*, *Linnaea borealis*, *Orthilia secunda*, *Prunus pumila*, *Pyrola asarifolia*, *Rubus canadensis* (unusually far south here), *Smilacina trifolia*, and *Sorbus decora*.

An especially interesting element of the flora is the large number of plants usually associated with coastal plain marshes in the SE United States (Fernald 1942; Reznicek 1994). A few examples include *Eleocharis melanocarpa*, *Fuirena squarrosa*, *Hemicarpha micrantha*, *Polygala cruciata*, *Psilocarya scirpoides*, *Rhexia virginica*, *Rhynchospora macrostachya*, and *Rotala ramosior*.

TABLE 2. Classification by habitat of Michigan extinct, endangered, threatened, and special concern plants known from Kalamazoo County (species list from <http://web4.msue.msu.edu/mnfi/> accessed 5/04). I have listed species typical of multiple plant communities in more than one cell.

Community	Extinct	Endangered	Threatened		Special Concern
Open Aquatic/ Wetland Submergent Marsh Emergent Marsh Coastal Plain Marsh Wet Meadow Bog Fen Wet Prairie	<i>Glyceria acutiflora</i> <i>Lemna valdiviana</i>	<i>Agalinis guttingeri</i> <i>Platanthera leucophaea</i> <i>Carex straminea</i> <i>Scleria pauciflora</i>	<i>Berula erecta</i> <i>Calamagrostis stricta</i> <i>Carex seorsa</i> <i>Cypripedium candidum</i> <i>Eryngium yuccifolium</i> <i>Filipendula rubra</i> <i>Fuirena squarrosa</i> <i>Gentianella quinquefolia</i> <i>Isoetia verticillata</i> <i>Juncus scirpoides</i> <i>Lechea pulchella</i>	<i>Muhlenbergia richardsonis</i> <i>Nelumbo lutea</i> <i>Panicum leibergii</i> <i>Platanthera ciliaris</i> <i>Poa paludigena</i> <i>Psilocarya scirpoides</i> <i>Sabatia angularis</i> <i>Stellaria crassifolia</i> <i>Valeriana edulis</i> <i>Zizania aquatica</i> var. <i>aquatica</i>	<i>Arnoglossum plantagineum</i> <i>Carex festucacea</i> <i>Cyperus flavescens</i> <i>Eleocharis engelmannii</i> <i>Eleocharis equisetoides</i> <i>Eleocharis melanocarpa</i> <i>Hemicarpha micrantha</i> <i>Hibiscus moschoetous</i> <i>Hypericum gentianoides</i> <i>Ludwigia alternifolia</i> <i>Lycopodiella appressa</i> <i>Polygala cruciata</i> <i>Rhexia virginica</i> <i>Rhynchospora macrostachya</i> <i>Rotala ramosior</i> <i>Scleria triglomerata</i> <i>Sporobolus heterolepis</i>
Shrub Dominated Wetlands Inundated Shrub Swamp Shrub-Carr					<i>Cuscuta campestris</i> <i>Cuscuta polygonorum</i> <i>Liparis liliifolia</i>
Forested Wetlands Tamarack Swamp Red Maple Swamp Black Ash Swamp Mixed Hardwood Swamp Floodplain		<i>Carex straminea</i> <i>Lygodium palmatum</i> <i>Populus heterophylla</i>	<i>Carex albolutescens</i> <i>Carex lupuliformis</i> <i>Diarrhena americana</i> <i>Dryopteris celsa</i> <i>Lycopus virginicus</i>	<i>Morus rubra</i> <i>Panax quinquefolius</i> <i>Valerianella chenopodiifolia</i>	<i>Carex frankii</i> <i>Euonymus atropurpurea</i> <i>Gymnocladus dioica</i> <i>Hybanthus concolor</i> <i>Liparis liliifolia</i> <i>Quercus shumardii</i> <i>Viburnum prunifolium</i>

Terrestrial Prairie, Shrub, & Savanna Terrestrial Prairie Black Oak Barren Bur Oak Savanna White Oak Savanna	<i>Aristida dichotoma</i> <i>Buchnera</i> <i>americana</i> <i>Digitaria filiformis</i> <i>Echinacea</i> <i>purpurea</i> <i>Liatis punctata</i>	<i>Baptisia</i> <i>leucophaea</i> <i>Gentiana alba</i> <i>Platanthera</i> <i>leucophaea</i>	<i>Artemisia ludoviciana</i> <i>Asclepias hirtella</i> <i>Aster sericeus</i> <i>Astragalus canadensis</i> <i>Besseyia bullii</i> <i>Bouteloua curtipendula</i> <i>Coreopsis palmata</i> <i>Draba reptans</i> <i>Eryngium yuccifolium</i> <i>Helianthus mollis</i> <i>Ipomoea pandurata</i>	<i>Linum virginianum</i> <i>Phlox bifida</i> <i>Platanthera ciliaris</i> <i>Silene stellata</i> <i>Silphium integrifolium</i> <i>Silphium laciniatum</i> <i>Silphium perfoliatum</i> <i>Solidago missouriensis</i> <i>Trichostema</i> <i>dichotomum</i> <i>Viola pedatifida</i>	<i>Amorpha</i> <i>canescens</i> <i>Angelica</i> <i>venenosa</i> <i>Arabis</i> <i>missouriensis</i> <i>var. deamii</i> <i>Asclepias</i> <i>purpurascens</i> <i>Astragalus</i> <i>neglectus</i> <i>Baptisia lactea</i> <i>Cirsium hillii</i> <i>Cuscuta</i> <i>pentagona</i> <i>Helianthus</i> <i>hirsutus</i>	<i>Hypericum</i> <i>gentianoides</i> <i>Kuhnia</i> <i>eupatorioides</i> <i>Lechea minor</i> <i>Lechea stricta</i> <i>Linum sulcatum</i> <i>Liparis liliifolia</i> <i>Penstemon</i> <i>pallidus</i> <i>Scleria</i> <i>triglomerata</i> <i>Scutellaria</i> <i>elliptica</i> <i>Sporobolus</i> <i>heterolepis</i>
Terrestrial Forest Sugar Maple Forest Oak Hardwood Forest		<i>Castanea dentata</i> (introduced)	<i>Carex oligocarpa</i> <i>Corydalis flavula</i> <i>Dryopteris celsa</i> <i>Eupatorium sessilifolium</i> <i>Orchis spectabilis</i> <i>Porteranthus trifoliatius</i>	<i>Hydrastis canadensis</i> <i>Panax quinquefolius</i> <i>Spiranthes ovalis</i> <i>Trillium sessile</i> <i>Triphora trianthophora</i>	<i>Adlumia</i> <i>fungosa</i> <i>Agrimonia</i> <i>rostellata</i> <i>Liparis liliifolia</i> <i>Scutellaria</i> <i>elliptica</i> <i>Smilax herbacea</i>	<i>Spiranthes</i> <i>ochroleuca</i> <i>Viburnum</i> <i>prunifolium</i>

TABLE 3. Native plants (including possibly adventive species) that are thought to be "Extinct" in Kalamazoo County.

<i>Adlumia fungosa</i>	<i>Eupatorium sessilifolium</i>	<i>Penstemon pallidus</i>
<i>Agalinis gattingeri</i>	<i>Gentiana alba</i>	<i>Platanthera hookeri</i>
<i>Arctostaphylos uva-ursi</i>	<i>Grindelia squarrosa</i>	<i>Platanthera leucophaea</i>
<i>Aristida dichotoma</i>	<i>Helianthus maximilianii</i>	<i>Potentilla arguta</i>
<i>Asclepias hirtella</i>	<i>Helianthus petiolaris</i>	<i>Pycnanthemum tenuifolium</i>
<i>Aster paternus</i>	<i>Hippuris vulgaris</i>	<i>Rosa setigera</i>
<i>Aster sericeus</i>	<i>Houstonia canadensis</i>	<i>Selaginella rupestris</i>
<i>Baptisia leucophaea</i>	<i>Lechea minor</i>	<i>Silphium laciniatum</i>
<i>Bromus kalmii</i>	<i>Lechea pulchella</i>	<i>Silphium terebinthinaceum</i>
<i>Buchnera americana</i>	<i>Lemna valdiviana</i>	<i>Spiranthes lacera</i>
<i>Corallorhiza trifida</i>	<i>Liatris punctata</i>	<i>Thaspium trifoliatum</i>
<i>Echinacea pallida</i>	<i>Linum sulcatum</i>	<i>Trichostema dichotomum</i>
<i>Echinacea purpurea</i>	<i>Nelumbo lutea</i>	<i>Triphora trianthophora</i>
<i>Equisetum scirpoides</i>	<i>Penstemon hirsutus</i>	<i>Tsuga canadensis</i>

TABLE 4. Native plants (including possibly adventive species) listed in the annotated checklist as "Current status uncertain, very rare if still extant." These species remain unaccounted for, but there is still a chance that they persist in unsearched areas of the county.

<i>Agalinis tennifolia</i>	<i>Eleocharis engelmannii</i>	<i>Phlox bifida</i>
<i>Allium cernuum</i>	<i>Epigaea repens</i>	<i>Physostegia virginiana</i>
<i>Arenaria stricta</i>	<i>Equisetum palustre</i>	<i>Platanthera orbiculata</i>
<i>Aristida necopina</i>	<i>Erigeron pulchellus</i>	<i>Polygala verticillata</i>
<i>Aster praealtus</i>	<i>Gaultheria hispidula</i>	<i>Porteranthus trifoliatius</i>
<i>Aster shortii</i>	<i>Glyceria acutiflora</i>	<i>Potamogeton richardsonii</i>
<i>Astragalus canadensis</i>	<i>Helianthus hirsutus</i>	<i>Psilocarya scirpoides</i>
<i>Astragalus neglectus</i>	<i>Hibiscus moscheutos</i>	<i>Ptelea trifoliata</i>
<i>Baptisia tinctoria</i>	<i>Hieracium venosum</i>	<i>Quercus shumardii</i>
<i>Calamovilfa longifolia</i>	<i>Hybanthus concolor</i>	<i>Rhexia virginica</i>
<i>Carex festucacea</i>	<i>Hypericum gentianoides</i>	<i>Scleria triglomerata</i>
<i>Carex lupuliformis</i>	<i>Ipomoea pandurata</i>	<i>Senecio pauperculus</i>
<i>Carex oligocarpa</i>	<i>Isotria verticillata</i>	<i>Solidago missouriensis</i>
<i>Carex umbellata</i>	<i>Juncus scirpoides</i>	<i>Sorbus decora</i>
<i>Carex virescens</i>	<i>Lechea stricta</i>	<i>Sparganium fluctuans</i>
<i>Cuscuta campestris</i>	<i>Linnaea borealis</i>	<i>Sparganium minimum</i>
<i>Cuscuta cephalanthi</i>	<i>Ludwigia alternifolia</i>	<i>Spiranthes romanzoffiana</i>
<i>Cuscuta coryli</i>	<i>Muhlenbergia richardsonii</i>	<i>Spiranthes vernalis</i>
<i>Cuscuta pentagona</i>	<i>Opuntia humifusa</i>	<i>Stipa spartea</i>
<i>Cuscuta polygonorum</i>	<i>Orobanche uniflora</i>	<i>Trillium erectum</i>
<i>Cyperus flavescens</i>	<i>Orthilia secunda</i>	<i>Valeriana edulis</i>
<i>Diarrhena americana</i>	<i>Panicum calliphyllum</i>	<i>Valerianella chenopodiifolia</i>
<i>Diervilla lonicera</i>	<i>Panicum philadelphicum</i>	
<i>Digitaria filiformis</i>	<i>Parthenium hispidum</i>	

Several other species have ranges that are basically Eastern North American including *Lygodium palmatum* (unusually disjunct to the NW from the rest of its range), and *Euthamia graminifolia* (infrequent, but not especially rare).

A large number of rare species extend into the county from the south, and are here at or near their extreme northern limits. A few of these include *Aesculus glabra*, *Gymnocladus dioicus*, *Hybanthus concolor*, *Platanthera ciliaris*, *Populus heterophylla*, *Porteranthus trifoliatius*, and *Rhynchospora globularis*.

Those specifically from the southwest and west (and presumably native) are

TABLE 5. "Very rare" plants (including possibly adventive species) in the annotated checklist.

<i>Aesculus glabra</i>	<i>Eryngium yuccifolium</i>	<i>Populus heterophylla</i>
<i>Agrimonia rostellata</i>	<i>Erythronium albidum</i>	<i>Prunus pumila</i>
<i>Angelica venenosa</i>	<i>Euonymus atropurpurea</i>	<i>Rhus aromatica</i>
<i>Arabis missouriensis</i>	<i>Filipendula rubra</i>	<i>Rhynchospora fusca</i>
<i>Arethusa bulbosa</i>	<i>Gaura biennis</i>	<i>Scheuchzeria palustris</i>
<i>Asclepias purpurascens</i>	<i>Gentianella quinquefolia</i>	<i>Scleria pauciflora</i>
<i>Asclepias viridiflora</i>	<i>Helianthus mollis</i>	<i>Silene stellata</i>
<i>Besseyia bullii</i>	<i>Kuhnia eupatorioides</i>	<i>Silphium perfoliatum</i>
<i>Carex albolutescens</i>	<i>Liatris cylindracea</i>	<i>Smilax herbacea</i>
<i>Carex frankii</i>	<i>Lilium philadelphicum</i>	<i>Spiranthes lucida</i>
<i>Carex jamesii</i>	<i>Lithospermum canescens</i>	<i>Spiranthes ochroleuca</i>
<i>Carex straminea</i>	<i>Lycopodiella inundata</i>	<i>Sporobolus heterolepis</i>
<i>Chaerophyllum procumbens</i>	<i>Lygodium palmatum</i>	<i>Tephrosia virginiana</i>
<i>Cirsium hillii</i>	<i>Lysimachia terrestris</i>	<i>Trillium sessile</i>
<i>Coeloglossum viride</i>	<i>Panicum leibergii</i>	<i>Viola pedatifida</i>
<i>Coreopsis palmata</i>	<i>Platanthera ciliaris</i>	<i>Xyris torta</i>
<i>Eleocharis quadrangulata</i>	<i>Platanthera flava</i>	
<i>Eriophorum tenellum</i>	<i>Polygala cruciata</i>	

mostly prairie plants and include; *Asclepias hirtella*, *Aster sericeus*, *Baptisia leucophaea*, *B. lactea*, *Eryngium yuccifolium*, *Liatris punctata*, *Panicum leibergii*, *Silphium integrifolium*, and *Viola pedatifida*.

Muhlenbergia richardsonis and *Valeriana edulis* are interesting Cordilleran disjuncts (Brodowicz 1989; Fernald 1942; Hanes 1942; McCann 1979; Peattie 1922; Voss 1972).

Introduced Species. Introduced (exotic) plants are a significant component of the Kalamazoo County flora, and today account for more than 25% of species. Quantitative data are mostly lacking, but clearly exotic plants vary considerably in their ability to invade native plant communities and in their effects on native vegetation. *Lonicera xbella* and its parents *L. morrowii* and *L. tatarica* (exotic honeysuckles) form near monocultures in the understories and at the edges of many oak hardwood forests, shading out native understory vegetation. *Alliaria petiolata* (Garlic Mustard) is a serious threat to the understory flora of sugar maple forests and most other lightly shaded habitats. *Robinia pseudoacacia* (Black Locust) has invaded many former prairies, savannas, and forest edges, and is shading out the last vestiges of native vegetation that cling to existence in the marginal habitats it prefers. *Lythrum salicaria* has invaded emergent marshes, including globally rare coastal plain marshes, and exotic strains of *Phragmites australis* have formed near-monocultures in bog, fen, wet meadow, wet prairie, and emergent marsh plant communities. These are just a few of the many problematic introduced species in Kalamazoo County.

Some plants such as *Gleditsia triacanthos*, *Phalaris arundinacea*, *Phragmites australis*, *Plantago rugelii*, *Portulaca oleracea*, and *Typha latifolia* (to name just a few) are probably represented by both native and exotic genotypes in Kalamazoo County.

Current Landscape & Flora. The current landscape of Kalamazoo County retains little of its original land cover as reported by the GLO surveys of

TABLE 6. Plants attributed to the flora of Kalamazoo County but not included in the Annotated Checklist.

Name	Source	Reason for Exclusion
<i>Agropyron spicatum</i>	Hanes & Hanes 1947	Not in Voss 1972
<i>Carya tomentosa</i>	Elliott 1960	No specimen, doubtful ID, not in Voss 1985 (see Manning 1973)
<i>Chenopodium pratericola</i> (= <i>C. dessicatum</i>)	Hanes & Hanes 1947	Immature material lacking fruit, not recognized by Voss 1985 (see Voss 1985)
<i>Chenopodium standleyanum</i>	Hanes & Hanes 1947	No specimen, not in Voss 1985
<i>Chenopodium urbicum</i>	Hanes & Hanes 1947	No specimen, not in Voss 1985
<i>Cleome serrulata</i>	Meagher & Tonsor 1992	No specimen, not in Voss 1985
<i>Crataegus dodgei</i>	Hanes & Hanes 1947	No specimen, not in Voss 1985
<i>Diplotaxis tenuifolia</i>	Elliott 1960	No specimen known
<i>Euphorbia humistrata</i>	Elliott 1960	Two purported specimens at KBSMS not examined, not in Voss 1985
<i>Fragaria vesca</i>	Hanes & Hanes 1947	Not in Voss 1985
<i>Galeopsis tetrahit</i>	Elliott 1960	No specimen known, not in Voss 1996
<i>Iris versicolor</i>	Brewer 1965	No specimen, out of range, probably <i>I. virginica</i>
<i>Juniperus horizontalis</i>	Elliott 1960	No specimen known, not in Voss 1972
<i>Lactuca floridana</i>	Hanes & Hanes 1947	No specimen, not in Voss 1996
<i>Lycium barbatum</i> (the Haneses' (1947) <i>L. halmifolium</i>)	Hanes & Hanes 1947	No specimen, not in Voss 1996
<i>Quercus imbricaria</i>	Beal 1903, Otis 1931	No specimen, not in Voss 1985 (see Wagner & Schoen 1976)
<i>Rosa nitida</i>	Elliott 1960	No specimen, not in Voss 1985
<i>Thalictrum pubescens</i>	Elliott 1960	No specimen, out of range, probably <i>T. dasycarpum</i>

1826–1830 (Figures 4–6). Vanishingly little of the landscape has escaped cultivation, pasturing, logging, or other conversion. No significant tracts of original wet prairie, terrestrial prairie, or oak savanna are known to survive. A complex and dynamic fragmented mosaic of relatively small plant community remnants, agricultural land, and urban and suburban landscapes remain (Brewer et al. 1969; Chapman 1984; Comer et al. 1995; Hodler et al. 1981).

Important Factors Affecting the Flora. Native Americans through their use of fire had a significant influence on the plant communities observed by the GLO surveyors and by early settlers in Kalamazoo County.

The grasses are supposed to be owing to the fires periodically lighted by the Indians in order to clear their hunting grounds . . ." (Cooper 1848, speaking of Prairie Ronde).

*"The prairie . . . seemed wondrously beautiful and grand. It was simply in a state of nature, covered with a pretty rank growth of grass, then [6 November 1831] dry and sere, no tree except the Big Island Grove ("Island Woods"), and one or two other small groves . . . Early in March the rank growth of last year's grass, dried by the sun and wind, was set on fire, and the whole prairie burned over, leaving it bare and black as midnight. Then in a few days came the beautiful flowers, covering the whole prairie with one uniform kind and color; first, the blue violet [*Viola pedatifida*], then the purple phlox [*Phlox pilosa*], and this succeeded by some other color. In July and August a tall, yellow flower, the name of which I do not know [probably *Silphium integrifolium*], mixed profusely with the tall grass [probably *Andropogon gerardii*], gave yellow as the predominating color. . . . But all was wild, with a peculiar, rank, sick smell, that even now almost brings back the shivers of the ague [recurring fever & chills caused by malaria]." (Brown, 1881, describing Prairie Ronde and Gourdneck Prairie).*

"I went out to Gull Prairie in the spring of [18]'33 with J. F. Gilkey; the prairie had been burnt over in the fall and the fresh green grass and the thousand wildflowers made it seem like a great garden. (Turner 1911, describing Gull Prairie).

The effects of the fur trade were also probably significant, not just from the standpoint of manipulating beaver and other animal populations, but also because they potentially affected land use patterns by Native Americans (e.g., during the Iroquois wars).

Changes in the ecology of Kalamazoo County plant communities are ongoing. Exotic plants, insects, fungi, bacteria, etc. continue to have serious consequences for the native flora (known examples are sometimes given in the annotated checklist). Invasion of exotic genetic material may also be an important factor affecting the ecology and evolution of the native flora. Plants that once existed, or currently exist as natives, but specimens of which have been imported from otherwise distant places may potentially contaminate local genotypes (if they exist—in most cases we don't know). These introductions also make it nearly impossible to determine if native genotypes of a species have been extirpated from the county. Several examples include *Bouteloua curtipendula*, *Echinacea purpurea*, and *Silphium terebinthinaceum*.

Clearly, the myriad biotic and abiotic changes that have occurred in Kalamazoo County natural communities over the last several hundred years have much affected the flora. In fact, few pre-European settlement natural communities can be said to persist, and many of the animals with which native plants once interacted have been extirpated or their numbers have changed dramatically.

Future of the Flora. The species richness of the Kalamazoo County flora is largely a result of the interdigitation of numerous and different, species rich plant communities (Figures 4–6), many of which have nearly disappeared. At the time of the GLO surveys (1826–1830), white oak savanna (79,746.8 acres), oak hardwood forest (78,209.1 acres), sugar maple forest (76,236.3 acres), black oak bar-

ren (40,225.2), and terrestrial prairie (more than 21,584 acres) were the most abundant plant communities. Prairie and bur oak savanna are now more or less extinct in Kalamazoo County. Black oak barren and white oak savanna have been reduced to a very few altered and tiny remnants despite once dominating the landscape. Oak hardwood forest and sugar maple forest are now limited to relatively small disturbed remnants that retain only a subset of their presettlement vegetation and structural characteristics.

More than 50% of original wetland acreage has been lost, and much of that which remains is highly fragmented and significantly altered from its pre-European settlement state (P. Comer pers. comm., Comer et al. 1995, pers. obs.). Spatially-explicit, cyclical, and (often) ancient disturbance regimes such as fire, drought, and flooding, have mostly been replaced by relatively novel stochastic disturbances.

Much has been lost, and how long that which remains will persist is unclear. Sprawl in southern Portage, and burgeoning development, especially in Alamo, Kalamazoo, Oshtemo, Richland, and Texas Tps. are claiming the last vestiges of once characteristic, widespread, and diverse plant communities. Too often, previously disturbed properties are left vacant while relatively undisturbed remnants of natural communities are developed, destroying or forever altering the biodiversity intricately associated with them.

The continued loss of native prairie, savanna, and wetland plants through fire suppression, outright habitat destruction, and the perturbation of forested and open wetlands (especially globally rare coastal plain marshes, fens, and floodplain forests) are perhaps the greatest immediate threats to the Kalamazoo County flora. Long-term declines in native plant species richness are apparent at the Hampton Creek Wetlands Complex, in the Sugarloaf Lakes Region (both in the Gourdneck State Game Area), at Camp Custer, and at all other long-studied, and relatively well-protected sites for native plant communities in Kalamazoo County (pers. obs.; C. R. Hanes unpublished data). I am aware of no significant exceptions.

Species that persist as relicts of practically extinct plant communities, and/or do not readily establish outside of former community remnants are those in most immediate danger of local extinction. Some examples of the former include many prairie, savanna, and open oak hardwood forest plants: *Angelica venenosa*, *Asclepias purpurascens*, *A. viridiflora*, *Baptisia lactea*, *Besseyia bullii*, *Eryngium yuccifolium*, *Gaura biennis*, *Liatris cylindracea*, *Panicum leibergii*, *Silene stellata* and *Viola pedatifida*, to name a few. Today these plants mostly persist in marginal habitats such as fencerows, forest edges, overgrown former savanna and prairie, and/or roadsides. Their former prairie, open forest, and savanna habitats have been more or less eliminated (Hanes & Hanes 1947; pers. obs.). Without the habitats and ecological interactions that native plants require for successful growth and reproduction, they cannot persist.

Aggressive native species and invasive exotics pose an additional significant threat to floristic diversity. The diverse native flora of Kalamazoo County is being slowly replaced by a lesser diversity of native and alien species better suited to the current highly fragmented and disturbed landscape. Here, most plants are subjected to a simpler suite of native biotic interactions than they once

were, including potentially fewer arthropod and mammalian herbivores, seed dispersers, pollinators, etc. Exotic plants have clearly altered plant community structure and dynamics.

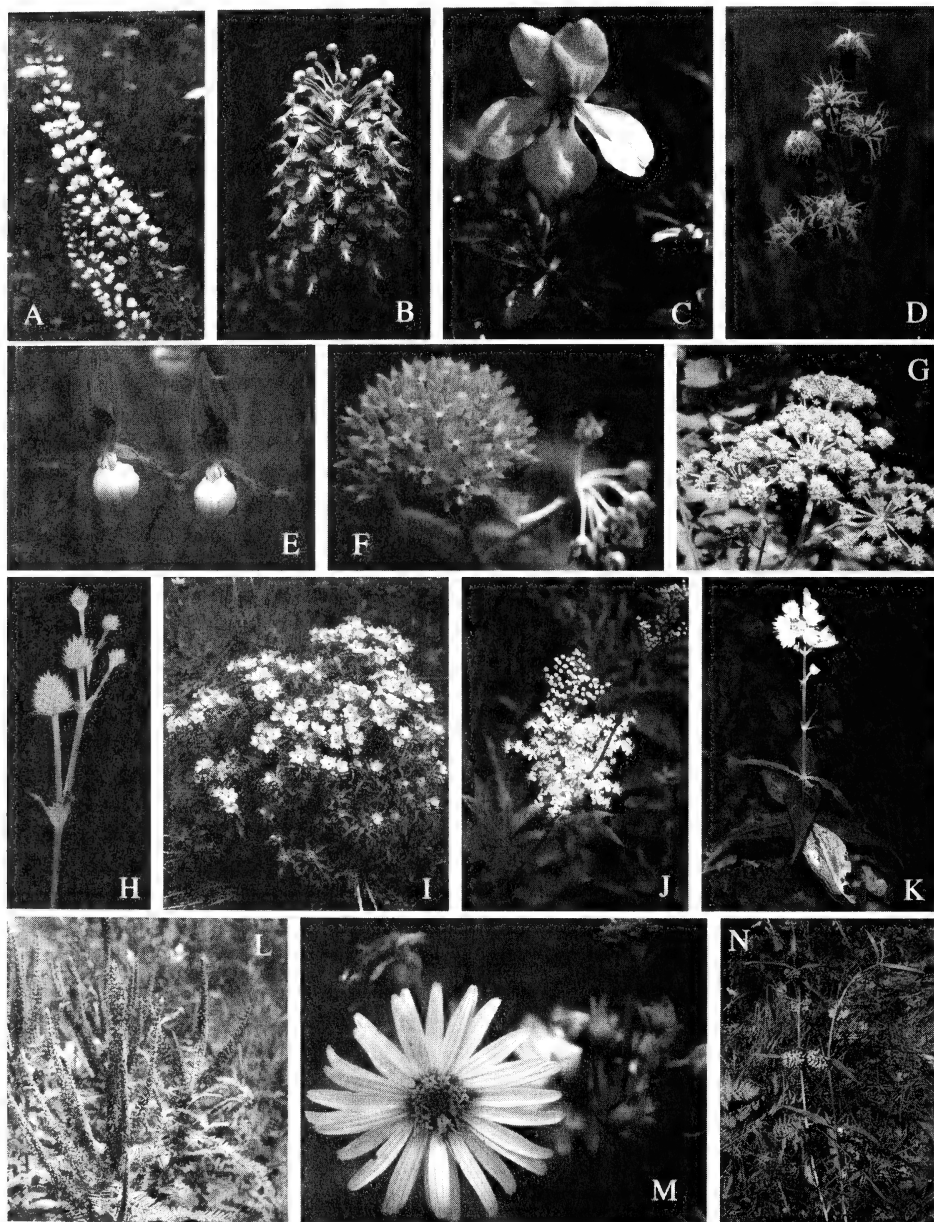
The native plants of Kalamazoo County do not exist in a vacuum. They require an ecological context that maintains at least some evolutionarily ancient and more or less coevolved interactions, as has been widely known for decades. Without a community of pollinators, seed dispersal agents, herbivores, wildfires, and other biotic and abiotic interactions, native plants are merely curiosities. They may as well be grown in a conservatory.

Clearly, many rare plants continue to decline in Kalamazoo County because the radical interventions their situations require (restoration of prairies and savannas, transplantation of plants persisting in marginal habitats, etc.) have not been forthcoming. Provisions for land planning and land management are much needed. Without ecologically sound land planning and restoration of existing protected habitat, the eventual fate of Kalamazoo County's rare plants seems abundantly clear. Many are destined to follow the former prairies and savannas to local and perhaps even eventual rangewide extinction (no doubt the same processes are occurring elsewhere throughout the ranges of many such species).

Some rare plants remain unprotected because sufficient data are not available to reliably determine their current status. Others are relatively more common elsewhere in Michigan and thus are not afforded protection (despite in many cases only persisting in widely separated, marginal habitats). Clearly, existing legislation alone cannot curb the ongoing decline in native plant species richness in Kalamazoo County and beyond.

Conservation-minded organizations have contributed substantially to the preservation and restoration of the Kalamazoo County flora, and their efforts should be applauded. However, much remains to be done. Numerous existing properties dedicated to the preservation of natural history are in drastic need of management. Some properties have been neglected for so long that some of the natural features they were intended to protect and preserve may be lost forever. Still other sites have long been known as local biodiversity hotspots (the Island Woods, LeFevre Bog, Stadium Drive savanna and wet prairie, Mud Lake Bog, etc.) but remain unprotected. Regardless of the degree of action that seems necessary, halting or even just slowing the decline in native plant species richness in Kalamazoo County is a daunting task. Existing natural areas are mostly too small, too isolated, too altered, and too little managed to provide refuge for most of the rare native flora. Further, the fencerow and RR right-of-way prairie and savanna relicts where so many of our native plants now persist, are not nearly as ecologically viable or economically practical to protect as are extensive, relatively intact Northern Great Lakes wetlands (for example). The magnificent biodiversity of Kalamazoo County is disappearing, and no end is in sight. That this trend is clearly being played out on a much larger scale is even more disheartening.

The loss is really much greater than just the plants themselves. Clearly, the ecological integrity of the landscape has been compromised, perhaps even thoroughly destroyed, such that without radical intervention much more of the native flora will disappear in the years to come. The thread that once held together the



(A.) *Baptisia lactea*, Rare (B.) *Platanthera ciliaris*, Very rare (C.) *Viola pedata*, Rare (D.) *Liatris cylindracea*, Very rare (E.) *Cypripedium candidum*, Rare (F.) *Asclepias purpurascens*, last population (G.) *Angelica venenosa*, last population (H.) *Eryngium yuccifolium*, last population (I.) *Lithospermum carolinense*, Very rare (J.) *Filipendula rubra*, photographed near Battle Creek in Calhoun Co., one population remaining in Kalamazoo County (K.) *Silene stellata*, last population (L.) *Amorphia canescens*, Rare (M.) *Silphium integrifolium*, Rare (N.) *Asclepias viridiflora*, photographed by R. W. Pippen at Hampton Creek ca. 1981, no longer extant at this site, one population remaining.

dynamic and diverse web of life in prairies, oak savannas, and beyond, has deteriorated to the point where there is no longer a viable context for a significant portion of the flora (and much of the rest of the biota).

Relictual plants may persist longer than once wide-ranging native animals such as the Regal Fritillary Butterfly, American Bison, or Greater Prairie-chicken, but taken as a whole, without informed land use planning, active management, and habitat protection, their demise is just as certain (Baker 1983; Brewer 1970). It is unclear exactly how many plant species have so far been eliminated (Tables 3–5), but clearly the fate of many that persist has been sealed. If current trends are any indication of the future, clearly time is running out for many of our remaining native plants and remnant plant communities.

ANNOTATED CHECKLIST OF VASCULAR PLANTS

Pteridophytes

LYCOPODIACEAE

Club Moss Family

Warren H. Wagner, Jr. annotated specimens of most species, and all hybrids reported here.

Diphasiastrum digitatum (Dill. ex A. Braun) Holub. **Hanes:** *Lycopodium flabelliforme*

Running Pine

Occasional. Rich SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. Rarely makes cones. Not in Hanes & Hanes (1947).

Diphasiastrum ×habereri (*D. digitatum* × *D. tristachyum*) Rare. Collected from “peat moss” on the border of a BOG in section 11 Texas Tp., and from moist sandy soil in a thicket at Sunset Lake. Last collected 21 August 1976.

Diphasiastrum tristachyum (Pursh) Holub. **Hanes:** *Lycopodium tristachyum*

Rare. OAK-HARDWOOD-FOREST in the south half of the county. Known to hybridize with *D. digitatum* forming the named hybrid *Diphasiastrum ×habereri* (see *D. digitatum*).

Huperzia lucidula (Michaux) Trevisan **Hanes:** *Lycopodium lucidulum*

Shining Club Moss

Occasional. HARDWOOD-SWAMP and RED-MAPLE-SWAMP, primarily in the western half of the county.

Lycopodiella inundata (L.) Holub. **Hanes:** *Lycopodium inundatum*

Bog Club Moss

Very rare. A large colony grows in moist loamy sand bordering a pond in Alamo Tp. Here the plants are associated with *Alettris farinosa*, *Viola palmata*, *Viola lanceolata*, *Viola sagittata*, *Hypericum prolificum*, *Lobelia siphilitica*, *Rhynchospora capitellata*, *Bartonia virginica*, *Scleria pauciflora*, and young *Quercus velutina*. No other extant sites are known. Collected by the Haneses from COASTAL-PLAIN-MARSH along the shores of Eagle and Pretty Lakes. The current status of the two Hanes sites is uncertain. Should be looked for in moist to wet sandy areas near water, especially at Pretty Lake, the only former site where significant intact habitat remains. Specimens from Eagle Lake and Pretty Lake are close to *L. appressa* (Chapman) Cranfill, but were not annotated by W. H. Wagner, Jr. and thus are maintained under this name.

Lycopodium clavatum L.

Trailing Club Moss

Occasional. SUGAR-MAPLE-FOREST and RED-MAPLE-SWAMP.

Lycopodium dendroideum Michaux **Hanes:** *L. obscurum* var. *dendroideum*
Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST.

Lycopodium obscurum L.

Ground Pine

Rare. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

SELAGINELLACEAE

Spike Moss Family

Selaginella eclipses W. R. Buck. **Hanes:** *S. apoda*

Creeping Selaginella

Common. FEN, SHRUB-CARR, WET-MEADOW, and other alkaline wetlands.

Selaginella rupestris (L.) Spring

Rock Selaginella

Extinct. Collected by the Haneses from BLACK-OAK-BARREN and hillside prairie in the west half of the county. Last collected from "pasturelands" near the city of Kalamazoo by Caroline N. Harvey on 27 July 1939.

ISOËTACEAE

Quillwort Family

Isoëtes echinospora Durieu. **Hanes:** *I. Braunii*

Quillwort

Rare. Collected by the Haneses (but originally found by H. R. Becker) at McGinnis Lake in sandy SUB-MARSH. The current status of this site is uncertain. Although plants have not been relocated, large areas of suitable habitat remain unsearched. Occasional in SUB-MARSH to about 2 m deep at Pretty Lake, and probably in other sandy-bottomed lakes. Does not appear to tolerate regular recreational disturbance (pers. obs.).

EQUISETACEAE

Horsetail or Scouring Rush Family

Equisetum arvense L.

Field Horsetail

Common. RR rights-of-way and roadsides, old fields, and other disturbed, open situations.

The hybrid *Equisetum ×litorale* (*E. arvense* × *E. fluviatile*) is known from several collections made from throughout the county.

Equisetum fluviatile L.

Swamp Horsetail

Common. FEN, TAMARACK-SWAMP, and EM-MARSH, especially in wet depressions. Known to hybridize with *E. arvense* forming the named hybrid *Equisetum ×litorale* (see *E. arvense*).

Equisetum hyemale L. **Hanes:** *E. prealtum*

Tall Scouring Rush

Common. Roadsides, RR rights-of-way and numerous other relatively open marginal habitats.

The hybrid *Equisetum ×ferrissii* (*E. hyemale* × *E. laevigatum*) is rare throughout. It is usually found in the vicinity of its putative parents on roadsides and in other disturbed situations. The Haneses called this hybrid *E. hyemale* var. *elatum*.

Equisetum laevigatum A. Braun

Smooth Scouring Rush

Occasional. WET-MEADOW, RR rights-of-way, and WET-PRAIRIE, mostly in the south half of the county. Includes *E. kansanum* as given in Hanes & Hanes, 1947.

The hybrid *Equisetum ×nelsonii* (*E. laevigatum* × *E. variegatum*) is occasional throughout along lakeshores in EM-MARSH, FEN, and in other wet seepy areas. Called *E. nelsoni* by the Haneses. Also known to hybridize with *E. hyemale* forming the named hybrid *Equisetum ×ferrissii* (see *E. hyemale*).

***Equisetum palustre* L.**

Marsh Horsetail

Current status uncertain, very rare if still extant. Known only from collections made by the Haneses near the border between sections 20 and 29 of Portage Tp. ("in and along the side of a small ditch emptying into Portage Creek $\frac{1}{4}$ mi. E of Hampton Lake"). Last collected at this site on 7 August 1939.

***Equisetum scirpoides* Michaux**

Sedge-like Scouring Rush

Extinct. Last collected by F. W. Rapp in 1936 from along the E shore of Austin Lake in "moist low ground" in an area then dominated by a mosaic of COASTAL-PLAIN-MARSH, open OAK-HARDWOOD-FOREST, sandy WET-PRAIRIE, and oak savanna. No other sites have ever been known. At the extreme SW edge of its known range.

***Equisetum sylvaticum* L.**

Wood Horsetail

Current status uncertain. Collected only by the Haneses from near Portage Creek in section 32 of Brady Tp., from a "RR bank W of Williams, Alamo Tp.", and from the "border of a wooded swamp N of Mud Lake, Pavilion Tp." No fertile specimens known.

OPHIOGLOSSACEAE**Adder's Tongue Family**

Several species are reported here for the first time in Kalamazoo County, based on specimens at WMU annotated by W. H. Wagner, Jr. *Botrychium matricariifolium* (Döll) Braun ex Koch., Daisy-leaf Grape-fern is reported by Brewer (1984) from the MI Central RR right-of-way on the extreme N edge of the former Genesee Prairie. This is however, not a typical habitat for this species which is also usually more northern in range. I have not been able to locate an herbarium specimen, and since *B. matricariifolium* resembles such rarities as *B. campestre* W. H. Wagner & Farrar (a prairie species) and several other relatively rare species of "moonworts," I have decided to withhold listing it in the checklist below until a specimen surfaces, or a new collection is made that will permit definitive identification. I saw one plant that resembled *B. matricariifolium* in 1998 growing beneath *Eupatorium maculatum* in shrubby former WET-MEADOW east of Oakland Dr. in Portage Tp. This specimen was not collected since no other plants were found. I never returned to the site to obtain a photo.

***Botrychium dissectum* Sprengel**

Cut-leaved Grape-fern

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST. *Botrychium dissectum* var. *obliquum* (Oblique Grape Fern) occurs in similar situations, but is less frequently encountered.

***Botrychium multifidum* (S. G. Gmelin) Ruprecht**

Leather Grape-fern

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Botrychium oneidense* (Gilbert) House**

Blunt-lobed Grape-fern

Current status unknown. Habitat unknown. Several specimens originally determined as *B. multifidum* have been re-identified by W. H. Wagner Jr. as this species. Not in Hanes & Hanes (1947).

***Botrychium rugulosum* W. H. Wagner**

Rugulose Grape-fern

Current status unknown. Habitat unknown. Several specimens originally determined as *B. multifidum* have been re-identified as this species (Wagner & Wagner 1982). Not in Hanes & Hanes (1947).

***Botrychium virginianum* (L.) Swartz**

Rattlesnake-fern

Occasional. OAK-HARDWOOD-FOREST.

Ophioglossum pusillum* Raf. Hanes: *O. vulgatum

Common Adder's-tongue

Current status uncertain. Collected by the Haneses from sandy moist to wet situations in the south half of the county (including sandy WET-PRAIRIE), usually near lakes. Not collected or observed since seen by the Haneses on 31 May 1946 "within a few feet of the water on the SE shore of West Lake." West Lake has primarily a sandy substrate and much of its shoreline is former Coastal Plain Marsh and sandy WET-PRAIRIE. Most known sites for this inconspicuous plant (including the aforementioned site) have since suffered mild to severe disturbance. It seems likely however that further searches of known former collection sites will identify extant populations.

DENNSTAEDTIACEAE***Pteridium aquilinum* L.**

Bracken

Common. Oak savanna, OAK-HARDWOOD-FOREST, dry sandy ecotone, and old fields.

LYGODIACEAE***Lygodium palmatum* (Bernh.) Swartz**

Climbing Fern

Very rare. Discovered by R. W. Pippen in May 1965 along a trail in the Gourdneck State Game Area (Pippen 1966). Persisting in 1999 despite increasing shade from tree and shrub growth. Associated with *Osmunda cinnamomea*, *O. regalis*, *Pinus banksiana*, *P. sylvestris* (both pines are planted), and *Toxicodendron vernix*. The origin of this plant is unknown. No additional plants have ever been located despite several decades of botanizing in the area by WMU botany courses. This site is substantially disjunct to the north and west of other known occurrences. Not in Hanes & Hanes (1947). Possibly introduced.

DRYOPTERIDACEAE

All hybrids and most species reported here were annotated by W. H. Wagner, Jr.

Athyrium felix-femina* (L.) Mertens Hanes: *A. angustum

Lady Fern

Occasional. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, TAMARACK-SWAMP, and relatively wet SUGAR-MAPLE-FOREST. All specimens are of the var. *angustum*.

***Athyrium thelypteroides* (Michaux) Desv.**

Silvery Spleenwort

Occasional. SUGAR-MAPLE-FOREST and RED-MAPLE-SWAMP.

Deparia acrostichoides* (Swartz) M. Kato. Hanes: *Polystichum acrostichoides

Christmas Fern

Common. SUGAR-MAPLE-FOREST. The forma *incisum* is known only from SUGAR-MAPLE-FOREST near Paw Paw Lake.

Diplazium pynocarpon* (Sprengel) M. Broun. Hanes: *Athyrium pynocarpon

Narrow-leaved Spleenwort

Occasional. Rich SUGAR-MAPLE-FOREST.

***Dryopteris celsa* (W. Palmer) Knowlton, W. Palmer & Pollard**

Log Fern

Rare. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, SUGAR-MAPLE-FOREST (only near swamp forests), and FLOODPLAIN-FOREST. *Dryopteris celsa* is a fertile allotetraploid (*D. goldiana* × *D. ludoviciana*). *Dryopteris celsa* is often associated with *D. cristata*, *D. goldiana*, and

D. clintoniana. Hybrids involving these and other species are not uncommon. According to W. H. Wagner Jr. (Wagner et al. 1969), *Dryopteris celsa* was once "exceedingly common" on Sugarloaf Island (the area is now occupied by a housing development). Not in Hanes & Hanes (1947).

The hybrids *Dryopteris celsa* \times *D. goldiana*, *D. celsa* \times *D. cristata*, and *D. celsa* \times *D. clintoniana* are also known from Sugarloaf Island. *Dryopteris celsa* \times *D. goldiana* and *D. celsa* \times *D. cristata* are reported from along Flowerfield Creek in Prairie Ronde Tp. (W. H. Wagner, Jr., MNFI site survey report; Wagner et al. 1969). *Dryopteris* \times *separabilis* (*D. celsa* \times *D. intermedia*) is known only from the "Island" woods in Schoolcraft and from near Flowerfield Creek, both in Prairie Ronde Tp. (collected by W. H. Wagner Jr., 5 April 1969 (WMU)). The status of these hybrids is unknown. Not in Hanes & Hanes (1947).

Dryopteris clintoniana (D. C. Eaton) Dowell **Hanes:** *Dryopteris cristata* var. *clintoniana*

Clinton's Wood Fern

Rare. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and SUGAR-MAPLE-FOREST (only near swamp forests). *Dryopteris clintoniana* is an allohexaploid hybrid between *D. cristata* and *D. goldiana*. It will hybridize with several other *Dryopteris* spp. It is often associated with *D. cristata*, *D. goldiana*, and hybrids involving these and other species.

Dryopteris celsa \times *D. clintoniana* is known only from Sugarloaf Island which has since been converted into a residential development. Not in Hanes & Hanes (1947).

Dryopteris cristata (L.) A. Gray

Crested Wood Fern

Common. RED-MAPLE-SWAMP and TAMARACK-SWAMP. Often in *Sphagnum* beneath Tamarack. Known to hybridize with *D. celsa*.

Dryopteris goldiana (Hook.) A. Gray

Goldie's Fern

Occasional. SUGAR-MAPLE-FOREST. Known to hybridize with *D. ludoviciana* forming the named hybrid *Dryopteris celsa*. Will also hybridize with *D. celsa* (see *D. celsa*).

Dryopteris intermedia (Muhl. ex. Willd.) A. Gray

Toothed Wood Fern

Occasional. HARDWOOD-SWAMP and RED-MAPLE-SWAMP. Hybridization is common between this species and other members of the *D. spinulosa* complex. Not in Hanes & Hanes (1947).

The hybrid *Dryopteris* \times *boottii* (*D. cristata* \times *D. intermedia*) is known only from HARDWOOD-SWAMP in Prairie Ronde Tp. (collected 5 April 1969 by W. H. Wagner, Jr.). Called *D.* \times *boottii* by the Haneses (1947). Will also hybridize with *D. celsa*. Current status of these hybrids is unknown.

The hybrid *Dryopteris* \times *triploidea* (*D. intermedia* \times *D. spinulosa*) is a triploid hybrid known only from specimens collected by W. H. Wagner, Jr. and R. W. Pippen on 3 October 1969 from HARDWOOD-SWAMP and RED-MAPLE-SWAMP in Prairie Ronde Tp., and by W. H. Wagner, Jr. on 20 May 1961 from "shaded rocky areas" in Parchment, Cooper Tp. The current status of these hybrids is unknown. Not in Hanes & Hanes (1947).

Dryopteris marginalis (L.) A. Gray

Marginal Shield Fern

Rare. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST, usually on sheltered hillsides.

Dryopteris spinulosa (O. F. Muell.) Watt.

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

Matteuccia struthiopteris (L.) Todaro **Hanes:** *Pteritis pensylvanica*

Ostrich Fern

Occasional. FLOODPLAIN-FOREST along the Kalamazoo River. The Haneses also report 2 locations in Brady Tp. The status of the Brady Tp. locations is unknown.

Onoclea sensibilis L.

Sensitive Fern

Common. Wet, open to lightly shaded situations including WET-PRAIRIE, FEN, SHRUB-CARR, and HARDWOOD-SWAMP.

Phegopteris hexagonoptera (Michaux) Fée **Hanes:** *Dryopteris hexagonoptera*

Broad Beech Fern

Current status uncertain. SUGAR-MAPLE-FOREST.

OSMUNDACEAE

Osmunda cinnamomea L.

Cinnamon Fern

Common. Shady, wet, usually acid situations including HARDWOOD-SWAMP, SHRUB-CARR, TAMARACK-SWAMP, BOG, and RED-MAPLE-SWAMP.

Osmunda claytoniana L.

Interrupted Fern

Rare. Open HARDWOOD-SWAMP and poorly-drained SUGAR-MAPLE-FOREST, usually near lakes. Rather local. The distribution of this species in Kalamazoo County is peculiar. Most apparently suitable sites (habitats resembling stations where the plant is known to grow) do not support it.

Osmunda regalis L.

Royal Fern

Common. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, FLOODPLAIN-FOREST, BOG, FEN, and SHRUB-CARR. All of our specimens are of the var. *spectabilis*.**PTERIDACEAE**

All hybrids and most species reported here were annotated by W. H. Wagner, Jr.

Adiantum pedatum L.

Maidenhair Fern

Occasional. Sheltered hillsides, usually near streams in SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

Asplenium platyneuron (L.) Britton, Sterns, & Poggenburg

Common. Dry to moist disturbed situations, especially beneath shrubs on roadsides, and in old fields. Widely established. Not in Hanes & Hanes (1947).

Cystopteris bulbifera L. Bernh.

Bulblet Bladder Fern

Current status unknown. Reported by the Haneses to grow on limestone rocks in sections 12 and 15 of Charleston Tp., and section 25 of Comstock Tp.

Cystopteris fragilis L. Bernh.

Brittle Fern

Occasional. Wooded hillsides near rivers or streams, especially in OAK-HARDWOOD-FOREST, and SUGAR-MAPLE-FOREST, but also sometimes found in swamp forests.

Cystopteris protrusa (Weatherby) Blasdel **Hanes:** *C. fragilis* var. *protrusa*

Southern Bladder Fern

Current status unknown. Collected by the Haneses from SUGAR-MAPLE-FOREST and rich HARDWOOD-SWAMP. Last collected in 1965 from SUGAR-MAPLE-FOREST (F. W. Rapp's woods), 6 mi. E of Vicksburg.

Cystopteris tenuis (Michaux) Desvaux **Hanes:** *C. fragilis* var. *mackayii*

Current status unknown. Collected by the Haneses from steep hillsides in SUGAR-MAPLE-FOR-

EST near the Kalamazoo River and near smaller waterways and ditches, mostly in the north half of the county.

***Woodwardia virginica* (L.) Sm.**

Virginia Chain Fern

Common. BOG.

THELYPTERIDACEAE

Thelypteris noveboracensis* (L.) Nieuwland Hanes: *Dryopteris noveboracensis

New York Fern

Occasional. Relatively open situations in hilly OAK-HARDWOOD-FOREST, usually adjacent to FEN or BOG.

Thelypteris palustris* Schott Hanes: *Dryopteris thelypteris

Marsh Fern

Common. BOG, FEN, WET-PRAIRIE, WET-MEADOW, and other relatively open swampy situations. All of our specimens are var. *pubescens*.

Gymnosperms

TAXACEAE

Yew Family

***Taxus canadensis* Marsh.**

Yew

Rare. A single small bush was found in a HARDWOOD-SWAMP in Portage Tp. in fall 1999. May have escaped from cultivation. Not in Hanes & Hanes (1947).

GINKGOACEAE

***Ginkgo biloba* L.**

Ginkgo

Rare. An escape from cultivation in gardens and hedges near the married housing complexes at WMU (pers. obs. 1995). All specimens I have found grew near a single planted female tree, and none exceeded 15 cm tall. Not in Hanes & Hanes (1947).

PINACEAE

Pine Family

***Abies balsamea* (L.) Miller**

Balsam Fir

Rare outside of cultivation. Only locally established. I first observed this species outside of cultivation at Bishop's Bog (Portage Tp.) in 1995. No trees with more than seven whorls of branches were found in a 1998 survey I made of this site. One small seedling (approx. 15 cm tall) was found on a steep, dry, gravelly hillside overgrown with brush on the WMU campus in 1996. Not in Hanes & Hanes (1947).

***Larix laricina* (DuRoi) K. Koch**

Larch; Tamarack

Common. TAMARACK-SWAMP, RED-MAPLE-SWAMP, FEN, and BOG. Despite a considerable loss in total acreage of TAMARACK-SWAMP and other wetlands, tamarack is still locally abundant in swampy situations throughout the county. The Haneses (1947) note that "many stands are dying out due to change of water level or to insect injury."

***Pinus banksiana* Lamb.**

Jack Pine

Locally established. A single population of about fifty small trees grows near several larger planted trees in a sandy former BLACK-OAK-BARREN in Alamo Tp. known by the Haneses as "Cold Springs." A few trees also appear to be growing outside of cultivation near planted trees along a power line ROW near Hampton Lake (Portage Tp.). Not in Hanes & Hanes (1947).

Pinus laricio* Poir. Hanes: *P. nigra

Austrian Pine

Collected in Camp Custer by H. R. Becker. Included in the Haneses' 1947 flora, but they were not sure if the one known specimen was planted. Not otherwise known outside of cultivation. The only specimen is of the var. *austriaca*.

***Pinus strobus* L.**

White Pine

Occasional as a native tree, primarily in the west half of the county in RED-MAPLE-SWAMP, BOG, and TAMARACK-SWAMP. A few old-growth trees persist alongside many younger individuals in RED-MAPLE-SWAMP west and north of Sugarloaf Island and near Goose Lake. Scattered individuals and small populations of relatively young trees can be found throughout the county, typically in dry ecotonal habitats and waste ground, usually on sandy substrates, and more often than not, near mature planted trees. Forest and wetland plant communities with white pine were rare here even before settlement. One of the best remaining examples of RED-MAPLE-SWAMP with white pine is located on private property just north of Sugarloaf Lake on the border of Mud Lake. The original stand of White Pine that once occurred here was mostly cut in the winter of 1900 (Haneses, unpublished notes), but has recovered impressively.

***Pinus sylvestris* L.**

Scotch Pine

First collected by Basil Stergios in 1969 near the Kellogg Biological Station in an old field where it was thought to be an escape from cultivation (MSC). Now rare throughout in disturbed situations where its status (planted/escaped) is often unclear. Not in Hanes & Hanes (1947).

***Tsuga canadensis* (L.) Carr.**

Hemlock

Extinct as a native species. A single specimen, then 18 inches in diameter was known from the edge of a "swamp" in section 20 of Prairie Ronde Tp. (last noted by the Haneses in 1947). The Haneses (1947) note that "in 1945 we were told by Grant Shutes, who was 77 years of age, that he had known this tree during his whole lifetime." This tree has not been relocated despite several attempts, and is thought to have since died. No other native examples of the species have ever been found in Kalamazoo County. A few young trees have been planted in a disturbed SUGAR-MAPLE-FOREST near Comstock.

CUPRESSACEAE**Cypress Family*****Juniperus communis* L.**

Common or Ground Juniper

Occasional. Mildly alkaline situations along roadsides, RR rights-of-way, and in disturbed OAK-HARDWOOD-FOREST.

***Juniperus virginiana* L.**

Red-cedar

Rare. RED-MAPLE-SWAMP, TAMARACK-SWAMP, and FEN. Usually only one or a few trees are found at a given site, but locally in Charleston Tp. it forms nearly monospecific stands in wet organic muck.

Monocotyledons**TYPHACEAE****Cat-tail Family*****Typha angustifolia* L.**

Narrow-leaved Cat-tail

Common. EM-MARSH. May be a mild halophyte along roadsides, or at least tolerates mild salinity and eutrophication as does the next species and their hybrid. Widely established.

The hybrid *Typha* \times *glauc*a (*T. angustifolia* \times *T. latifolia*) is rare throughout (probably overlooked) in EM-MARSH, WET-MEADOW, FEN, and in roadside ditches. The Haneses called this hybrid *T. angustifolia* var. *elongata*.

***Typha latifolia* L.**

Common Cat-tail

Common. Almost all relatively stagnant moist to inundated and relatively open situations. Like *T. angustifolia* it may be a mild halophyte and seems to thrive under eutrophic conditions. Known to hybridize with *T. angustifolia* forming the named hybrid *Typha* \times *glauc*a (see *T. angustifolia*).

SPARGANIACEAE

Bur-reed Family

***Sparganium americanum* Nutt.**

Occasional. SUB-MARSH of small lakes.

***Sparganium chlorocarpum* Rydb.**

Occasional. SUB-MARSH, EM-MARSH, and SHRUB-SWAMP associated with lakes and streams, especially at their inlets and outlets.

***Sparganium eurycarpum* Engelm.**

Occasional. SUB-MARSH and EM-MARSH at the borders of ponds, streams, and the Kalamazoo River.

***Sparganium fluctuans* (Morong) Robinson**

Current status uncertain, very rare if still extant. Collected by the Haneses only from a "marsh" in "the E Lake of Three Lakes, Richland Tp."

***Sparganium minimum* (Hartman) Fries**

Current status uncertain, very rare if still extant. Collected by the Haneses from muddy EM-MARSH in a small pond in Texas Tp. (Hanes 1943). No other sites or collections are known.

POTAMOGETONACEAE

Pondweed Family

Very few *Potamogeton* were sought in the field during the course of this study. I have thus relied heavily on specimens annotated by E. G. Voss to document our many species. Relatively few collections of *Potamogeton* have been made in Kalamazoo County since publication of the Haneses' (1947) flora, so the treatment for most species is necessarily brief and generally lacking contemporary data describing frequency and distribution. Habitat data have sometimes been gleaned from label data on old herbarium specimens. *Potamogeton vaseyi* is not included here because the only known records are of specimens at MSC and MICH whose annotations read "lake near Hickory Corners," suggesting to me that they were probably collected in Barry County.

***Potamogeton amplifolius* Tuckerman**

Common. SUB-MARSH of lakes throughout.

***Potamogeton berchtoldii* Fieber**

Current status uncertain. SUB-MARSH of sandy-bottomed lakes.

***Potamogeton crispus* L.**

Common. SUB-MARSH of lakes, streams, and the Kalamazoo River.

***Potamogeton epihydrus* Raf.**

Current status uncertain. Reportedly once "common" in SUB-MARSH at Thrall Lake, Brady Tp. (Hanes & Hanes 1947).

***Potamogeton filiformis* Pers.**

Current status unknown. SUB-MARSH. Not in Hanes & Hanes (1947).

***Potamogeton foliosus* Raf.**

Current status uncertain. SUB-MARSH of streams and lakes.

***Potamogeton friesii* Rupr.**

Current status uncertain. Collected by the Haneses from SUB-MARSH in Barton Lake Creek.

***Potamogeton gramineus* L.**

Occasional. Lakes with sandy bottoms, mostly in the western half of the county. Hybrids between this species and *P. illinoensis* are known from Kalamazoo County (Voss 1972).

***Potamogeton illinoensis* Morong**

Current status uncertain. SUB-MARSH of lakes and streams.

***Potamogeton natans* L.**

Occasional. SUB-MARSH of the Kalamazoo River, lakes, and streams.

***Potamogeton nodosus* Poirét**

Current status unknown. Collected throughout by the Haneses from SUB-MARSH in the Kalamazoo River, lakes, and streams.

***Potamogeton oakesianus* Robbins**

Current status uncertain. Collected by the Haneses from BOG, lakes, and streams. Usually grows on "false-bottoms."

***Potamogeton pectinatus* L.**

Sago Pondweed

Common. SUB-MARSH in lakes and streams.

***Potamogeton praelongus* Wulfen**

Current status uncertain. Collected throughout by the Haneses from SUB-MARSH in lakes.

***Potamogeton pusillus* L.**

Current status unknown. Collected by the Haneses from SUB-MARSH in ponds and streams in the southwestern quarter of the county.

***Potamogeton richardsonii* (Benn.) Rydb.**

Current status uncertain, very rare if still extant. Collected by J. J. Jackson on 5 July 1916 at Gull Lake, growing in "standing, open water . . ." (OLV). Two other collections are known from Gull Lake, one from 1926, and another from 1941. The 1941 collection notes that the plants occurred in 3–8 feet of water over a "marl-muck" substrate (MSC). Not in Hanes & Hanes (1947).

***Potamogeton robbinsii* Oakes**

Current status unknown. Collected by the Haneses from SUB-MARSH in Austin and Long Lakes.

***Potamogeton strictifolius* Bennett**

Current status unknown. Collected by the Haneses from SUB-MARSH in Campbell and Sugarloaf Lakes.

***Potamogeton vaginatus* Turcz.**

Current status unknown. SUB-MARSH. Not in Hanes & Hanes (1947).

***Potamogeton zosteriformis* Fern.**

Common. Shallow to deep water in lakes, streams, ponds, and the Kalamazoo River.

NAJADACEAE**Naiad Family*****Najas flexilis* (Willd.) Rostk. & Schmidt**

Common. SUB-MARSH of lakes and streams.

Najas gracillima (A. Br.) Magnus

Occasional. SUB-MARSH of mostly sand and gravel bottomed lakes. Not native.

Najas guadalupensis (Sprengel) Magnus

Current status unknown. Collected by the Haneses from SUB-MARSH in mostly sand and gravel bottomed lakes. Some sterile specimens resemble *N. olivacea*. All reports of *N. olivacea* from Kalamazoo County probably refer to this species (Voss 1972).

Najas marina L.

Current status unknown. First collected by M. McCann in 1976 from Asylum Lake where it is now occasional in SUB-MARSH near the outlet. Collected by T. D. Trana in 1993 from wet mucky SUB-MARSH in a pond at Fort Custer (MICH). Not native. Not in Hanes & Hanes (1947).

JUNCAGINACEAE**Arrow-grass Family***Scheuchzeria palustris* L.

Very rare. Known only from Bishop's Bog where it grows in wet open *Sphagnum*. Sterile plants are abundant, but relatively few fertile plants have been seen in countless visits to the site (1994–2002). Interestingly, no plants are known from the nearby West Lake Bog. Not known elsewhere in Kalamazoo County.

Triglochin maritimum L. **HANES:** *T. maritima*

Occasional. FEN sedge meadow.

Triglochin palustre L. **HANES:** *T. palustris*

Rare. Wet mucky lakeshores, often on sedge "hummocks" (but not usually *Sphagnum*) near open water. Often associated with *Liparis loeselii*.

ALISMATACEAE**Water-plantain Family***Alisma plantago-aquatica* L. **Hanes:** *A. subcordatum* & *A. trivale*

Water-plantain

Occasional. WET-MEADOW, SHRUB-SWAMP, and EM-MARSH associated with ponds, lakes, and ditches.

Sagittaria cuneata Sheldon

Wapato; Duck-potato

Current status uncertain. EM-MARSH. Several Hanes specimens of this species were long mistaken for *S. graminea*.

Sagittaria graminea Michaux

Current status uncertain. SUB-MARSH and EM-MARSH in lakes, mostly in the southern half of the county (See *S. cuneata*).

Sagittaria latifolia Willd.

Wapato; Duck-potato

Common. SHRUB-SWAMP, SUB-MARSH, EM-MARSH, and WET-MEADOW associated with ponds, lakes, streams, and ditches.

Sagittaria rigida Michaux

Occasional. SUB-MARSH and EM-MARSH of sandy-bottomed lakes in the western half of the county.

HYDROCHARITACEAE**Frog's-bit Family***Elodea canadensis* Michaux **Hanes:** *Anacharis canadensis*

Common. SUB-MARSH in (usually) marly lakes and streams.

Elodea nuttallii (Planchon) St. John **Hanes:** *Anacharis occidentalis*

Occasional. SUB-MARSH in lakes and streams.

***Vallisneria americana* Michaux**

Tape-grass; Wild-celery

Occasional. SUB-MARSH in the Kalamazoo River, lakes, and streams. Apparently most frequent in the eastern half of the county.

GRAMINEAE (POACEAE) Hanes: GRAMINEAE**Grass Family**

This is a large and diverse family in Kalamazoo County. Several species are reported here based on annotations made to specimens in the WMU Hanes herbarium and elsewhere by E. G. Voss and mapped in Volume I of Michigan Flora (1972).

***Agropyron repens* (L.) Beauv.**

Quack Grass

Common. Lawns, cultivated fields, and roadsides.

***Agropyron smithii* Rydb.**

Bluestem

Current status uncertain. Collected from along roadsides and RR rights-of-way. Locally established.

***Agropyron trachycaulum* (Link) Malte**

Wheatgrass

Current status uncertain. WET-MEADOW, HARDWOOD-SWAMP, and roadsides.

***Agrostis gigantea* Roth**

Redtop

Occasional. RR rights-of-way, roadsides, and old fields. Widely established.

Agrostis hyemalis* (Walter) BSP. Hanes: *A. scabra

Ticklegrass

First reported in Kalamazoo County from Schoolcraft Tp. in 1993 where it was found in fields and moist open disturbed ground. It is now an occasional weed in Schoolcraft Tp., and may be overlooked elsewhere in the county (MICH). Not native.

***Agrostis perennans* (Walter) Tuckerman**

Autumn or Upland Bent

Current status uncertain. Dry, sandy, disturbed situations. Not native.

Agrostis stolonifera* L. Hanes: Includes *A. palustris* & *A. alba

Creeping Bent

Current status unknown. First collected on 7 July 1934 from "marshes" in section 20 of Portage Tp. Later collected in Alamo Tp. Few collections are known. May be at least partly native here (Voss 1972).

***Alopecurus aequalis* Sobol**

Current status unknown. First collected by the Haneses on 3 June 1934 in section 22 of Schoolcraft Tp. from "marsh." The Haneses made another collection in 1942 but no additional specimens are known. Not native.

***Alopecurus carolinianus* Walter**

Current status unknown. First collected by the Haneses in May 1934. Several collections thereafter are from "marshes" and "low ground" in the vicinity of Schoolcraft. Last collected in 1939. Probably adventive.

***Alopecurus pratensis* L.**

Current status unknown. Known from one collection made by the Haneses and H. R. Becker in 1937 from a field on Becker's farm in Charleston Tp. Not native.

***Andropogon gerardii* Vitman**

Big Bluestem; Turkeyfoot

Occasional. Roadsides and RR rights-of-way, in prairie and savanna cemeteries, and in TERRESTRIAL-PRAIRIE, WET-PRAIRIE, FEN, WHITE-OAK-SAVANNA, and BUR-OAK-SAVANNA.

Andropogon scoparius* Michaux Hanes: *Schizachyrium scoparium

Little Bluestem

Common. Roadsides and RR rights-of-way, dry to dry-mesic remnant TERRESTRIAL-PRAIRIE, WHITE-OAK-SAVANNA, and BLACK-OAK-BARREN. Sometimes a local component of prairie-FEN meadow.

***Andropogon virginicus* L.**

Broom-sedge

Occasional. Sandy lakeshores including COASTAL-PLAIN-MARSH.

***Anthoxanthum odoratum* L.**

Sweet Vernal Grass

Current status unknown. Collected by the Haneses from the edge of a woods SE of Sugarloaf Lake in section 4 of Schoolcraft Tp. Not native.

***Aristida basiramea* Vasey**

Forked Triple-awned Grass

Occasional. Sandy soil of BLACK-OAK-BARREN, and other dry, sandy open situations, especially old fields (Hermann 1936). Probably adventive.

***Aristida dichotoma* Michaux**

Poverty Grass

Extinct. Collected only by the Haneses from a "sterile gravelly field" in section 16 of Charleston Tp. (Hermann 1936). Possibly adventive.

Aristida necopina* Shinnery Hanes: *A. intermedia

Current status uncertain, very rare if still extant. First collected by the Haneses 1 September 1942 from a sandy old field in section 8 of Brady Tp. Possibly adventive (Hanes 1945b).

***Aristida oligantha* Michaux**

Prairie Triple-awned Grass

Occasional. RR rights-of-way and other dry, sandy situations including old fields and disturbed BLACK-OAK-BARREN. Probably adventive.

***Aristida purpurascens* Poir.**

Arrow Grass

Common. BLACK-OAK-BARREN and other dry and sandy disturbed situations. Possibly adventive.

***Arrhenatherum elatius* (L.) Presl**

Tall Oatgrass

Current status unknown. Roadsides. Known only from the southwest quarter of the county. Not native.

***Avena sativa* L.**

Oats

Occasional. An escape from cultivation along RR rights-of-way and roadsides mostly in the southwest quarter of the county.

***Bouteloua curtipendula* (Michaux) Torrey**

Grama Grass

Current status as a native species uncertain. Very rare if still extant. Collected by the Haneses from a relatively open former hillside WHITE-OAK-SAVANNA (hillside prairie) near Potter Lake (some labels read Potter's Lake), in Climax Tp. First collected at this site by L. A. Kenoyer in the early 1900s, where he noted that it was "common on shores and hills." Also collected by the Haneses from just a few hundred meters to the north of Potter Lake, on the south shore of McGinnis Lake. These sites are now dominated by OAK-HARDWOOD-FOREST, and most of the few remaining openings have been colonized by exotic shrubs and young native trees. I have not found any potentially native specimens in several years of searching. Collected by the first botanical survey at Grand Prairie. In-

roduced specimens grow in wildflower plantings at the intersection of Oakland Dr. with I-94 and in several places along I-94 near the E edge of the county (1997).

Brachyelytrum erectum (Roth) Beauv.
Occasional. SUGAR-MAPLE-FOREST.

Bromus briziformis Fischer & Meyer
Quake Grass
Current status unknown. Roadsides. Not native.

Bromus ciliatus L.
Fringed Brome
Occasional. Open situations in TAMARACK-SWAMP, WET-MEADOW, FEN, and BOG.

Bromus commutatus Schrader
Hairy Chess
Current status unknown. Collected by the Haneses from roadsides in the southwestern quarter of the county. Not native.

Bromus inermis Leysser
Smooth Brome
Once "infrequent" near Schoolcraft (Hanes & Hanes 1947). Now common throughout along roadsides, RR rights-of-way, and in other moist to wet open situations. Widely established.

Bromus japonicus Murray
Japanese Brome
Common. RR rights-of-way and old fields. Widely established.

Bromus kalmii Gray
Kalm's Chess
Extinct. Collected by the Haneses from a roadside SE of Alamo. May have been introduced, or a relict of former oak savanna or prairie.

Bromus latiglumis (Shear) Hitchc.
Current status unknown. Collected by the Haneses from WET-MEADOW and "swamps" where it was "local."

Bromus mollis L.
Soft Chess
Occasional. Roadsides and old fields. Widely established.

Bromus pubescens Willd. **Hanes:** *B. purgans*
Canada Brome
Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

Bromus secalinus L.
Cheat; Chess
Common. Dry, often sandy terrestrial situations, especially roadsides and RR rights-of-way. Widely established.

Bromus squarrosus L.
Corn Brome
Current status unknown. Collected by the Haneses from a RR right-of-way 2 mi. N of Schoolcraft where first noticed by F. W. Rapp in 1938. Not native.

Bromus tectorum L.
Downy Chess
Occasional. Dry, open terrestrial situations. Not native.

***Calamagrostis canadensis* (Michaux) Beauv.**

Blue-joint

Common. FEN, WET-MEADOW, COASTAL-PLAIN-MARSH, WET-PRAIRIE, and other moist to wet open situations.

***Calamagrostis inexpansa* Gray**

Bog Reed Grass

Current status unknown. Collected by the Haneses from "a swamp along the Grand Trunk railway 3.5 miles SW of Schoolcraft," from the "S shore of Blue Lake" in section 34 of Charleston Tp., and collected by F. W. Rapp "in a swamp SW of Vicksburg."

Calamagrostis stricta* (Timm) Koeler **Hanes:** *C. neglecta

Rare. FEN and less frequently in seepage BOG (in fen-like microclimates) especially in the vicinity of the Sugarloaf Lakes and Hampton Creek. Usually growing in muck at stream edges, or in open FEN sedge meadow. A large and perennially very wet FEN sedge meadow near Sugarloaf Lake is covered with a dense growth of this species over several acres (last observed in 1999). Also reported by the Haneses from "swamps" and "shores" at several other rather widely scattered locations.

***Calamovilfa longifolia* (Hooker) Scribner**

Long-leaved Reed Grass

Current status uncertain, very rare if still extant. Collected by the Haneses from a RR right-of-way 6 mi. SW of Schoolcraft (Hanes 1945b). Possibly adventive.

***Cenchrus longispinus* (Hackel) Fern.**

Sandbur; Sandspur

Rare. Sandy, open, disturbed ground including roadsides, lawns, and lakeshores. Not native.

***Cinna arundinacea* L.**

Wood Reed Grass

Occasional. HARDWOOD-SWAMP and RED-MAPLE-SWAMP.

***Cynodon dactylon* (L.) Pers.**

Bermuda Grass

Common. Grows in a diversity of disturbed open situations. Widely established.

***Cynosurus cristatus* L.**

Crested Dog's-tail Grass

Not known since collected by L. A. Kenoyer in 1929 from a "grass lawn" at Ramona Park, Long Lake. Not native.

***Cynosurus echinatus* L.**

Current status unknown. First collected in 1967 by S. Stephenson where "well-established" on a dry, W-facing slope near the N edge of Wintergreen Lake in the Kellogg Bird Sanctuary (MSC). Also scattered along a nearby road and marsh edge (Stephenson 1967). Not native. Only collection known from Michigan. Not in Hanes & Hanes (1947).

***Dactylis glomerata* L.**

Orchard Grass

Common. Moist to wet open situations. Widely established.

***Danthonia spicata* (L.) R. & S.**

Poverty Grass; Oatgrass

Current status uncertain. Disturbed, dry, sandy soil. May have once occurred in TERRESTRIAL-PRAIRIE.

***Deschampsia cespitosa* (L.) Beauv.**

Tufted Hair Grass

Rare. Marly lakeshores.

Diarrhena americana Beauv.

Current status uncertain, very rare if still extant. Collected only by the Haneses from E of Galesburg near the Kalamazoo River "in small colonies in moderately moist soil" in FLOODPLAIN-FOREST. Not since known from Kalamazoo County.

Digitaria filiformis (L.) Koeler

Current status uncertain, very rare if still extant. Known from a single collection made by the first botanical survey at Grand Prairie (TEX). This specimen is listed in unpublished notes prepared by R. McVaugh on the first botanical survey collections. Although I have not seen the specimen, I accept it here based upon his determination. There is a rather poor specimen in the A. C. Roberts collection (KVM) that may belong to this species. Not in Hanes & Hanes (1947).

Digitaria ischaemum (Schreber) Muhl.

Smooth Crab Grass

Occasional. Open disturbed situations. Widely established.

Digitaria sanguinalis (L.) Scop.

Large Crab Grass

Common. Lawns, cultivated fields, and roadsides. Widely established.

Echinochloa crusgalli (L.) Beauv.

Barnyard Grass

Common. Lawns, cultivated fields, and roadsides. Widely established.

Echinochloa muricata (Beauv.) Fern. **Hanes:** *E. pungens*

Wild Millet

Current status unknown. Collected by the Haneses from wet ground at lake edges in EM-MARSH?, and from dry exposed pond basins.

Echinochloa walteri (Pursh) Heller

Current status uncertain. Collected by the Haneses from along creeks and the Kalamazoo River.

Eleusine indica (L.) Gaertner

Goose Grass

Occasional. Open waste ground and lawns. Not native.

Elymus canadensis L.

Nodding Wild Rye

Occasional. RR rights-of-way and roadsides, especially in remnant TERRESTRIAL-PRAIRIE, and near lakeshores. Mostly in the southwest quarter of the county. Voss (1972) cites a specimen from Kalamazoo County with "glabrous, or merely scabrous lemmas" [f. *glaucofolius*].

Elymus riparius Wieg.

River-bank Wild Rye

Occasional. Known primarily from along the Kalamazoo River E of Kalamazoo in FLOODPLAIN-FOREST and associated WET-MEADOW.

Elymus villosus Willd.

Slender Wild Rye

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. May once have occurred in oak savanna.

Elymus virginicus L.

Wild Rye

Occasional. HARDWOOD-SWAMP, SUGAR-MAPLE-FOREST, and FLOODPLAIN-FOREST.

***Eragrostis cilianensis* (All.) Mosher**

Stink Grass

Current status unknown. Lawns, fields, and roadsides. Not native.

***Eragrostis frankii* Steudel**

Frank's Lovegrass

Current status uncertain. Collected by the Haneses from "mud flats" along the Kalamazoo River, and from "moist open ground" essentially throughout.

***Eragrostis hypnoides* (Lam.) BSP.**

Creeping Eragrostis

Current status unknown. Collected by the Haneses from along "gravelly or muddy shores" of the Kalamazoo River, and from near "creeks."

***Eragrostis pectinacea* (Michaux) Nees**

Small Tufted Lovegrass

Current status uncertain. Disturbed open situations.

Eragrostis poaeoides* R. & S. Hanes: *E. minor

Current status unknown. RR rights-of-way and old fields in sandy soil. Not native.

***Eragrostis spectabilis* (Pursh) Steudel**

Tumble Grass

Occasional. Mostly in the western half of the county along RR rights-of-way and in disturbed former BLACK-OAK-BARREN.

***Festuca obtusa* Biehler**

Nodding Fescue

Occasional. All kinds of terrestrial forests.

Festuca octoflora* Walter Hanes: *Vulpia octoflora

Six-weeks Fescue

Occasional. Open situations with dry soil.

***Festuca ovina* L.**

Sheep Fescue

Occasional. Dry, sandy old fields and other disturbed situations. Not native.

Festuca pratensis* Hudson Hanes: *F. elatior

Meadow Fescue

Common. Roadsides, fields, and other disturbed situations. Widely established.

***Festuca rubra* L.**

Red Fescue

Occasional. Lawns, old fields, and a diversity of other open, usually disturbed situations. Native and introduced plants occur here.

***Glyceria acutiflora* Torrey**

Sharp-scaled Manna Grass

Current status uncertain, very rare if still extant. Known from collections made by the Haneses from "wet soil along an old ditch" in the southwest quarter of section 22 Schoolcraft Tp. (Hermann 1936). Also collected by F. W. Rapp in "the Vicksburg drain E of the railroad tracks in section 18 of Brady Tp." Possibly adventive.

***Glyceria borealis* (Nash) Batchelder**

Northern Manna Grass

Occasional. TAMARACK-SWAMP and EM-MARSH.

Glyceria canadensis (Michaux) Trin.

Rattlesnake Grass

Occasional. FEN, WET-MEADOW, open RED-MAPLE-SWAMP, and TAMARACK-SWAMP.

Glyceria grandis S. Watson

Reed Manna Grass

Current status uncertain. Reported by the Haneses only from a collection made by H. R. Becker in section 30 of Charleston Tp. Keough & Pippen (1981) report this species as "frequent" in a BOG S of Centre St. E of US 131 in the Gourdneck State Game Area, where it was associated with *Aronia prunifolia*, *Carex oligosperma*, *Dulichium arundinaceum*, and *Woodwardia virginica*. I have not seen a herbarium specimen from this site.

Glyceria septentrionalis Hitchc.

Floating Manna Grass

Current status uncertain. EM-MARSH and SHRUB-SWAMP.

Glyceria striata (Lam.) Hitchc.

Fowl Manna Grass

Occasional. SUGAR-MAPLE-FOREST, HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and FLOODPLAIN-FOREST.

Hierochloë odorata (L.) Beauv.

Sweet Grass

Occasional. FEN.

Holcus lanatus L.

Velvet Grass

Current status unknown. Collected by the Haneses from wet woods and marsh edges, mostly in the SW ¼ of the county (Hanes 1940). Not native.

Hordeum jubatum L.

Squirrel-tail Grass

Common. Roadsides and old fields. Not native.

Hystrix patula Moench

Bottlebrush Grass

Common. Terrestrial forests, especially SUGAR-MAPLE-FOREST.

Leersia oryzoides (L.) Sw.

Cut Grass

Occasional. SHRUB-SWAMP, WET-MEADOW, FEN, EM-MARSH, and openings in TAMARACK-SWAMP.

Leersia virginica Willd.

White Grass

Occasional. HARDWOOD-SWAMP and SUGAR-MAPLE-FOREST.

Leptochloa fascicularis (Lam.) Gray

Sprangletop; Salt Meadow Grass

Current status unknown. First collected in 1966 from "recently disturbed ground" in a plantation between 42nd St. and Augusta Crk. in the Kellogg Forest (MSC) (Stephenson 1967). Not native. Not in Hanes & Hanes (1947).

Leptoloma cognatum (Schultes) Chase

Fall Witch Grass

Occasional. Dry sandy situations along roadsides and RR rights-of-way, and in old fields.

***Lolium perenne* L.**

Ryegrass

Widely grown as a lawn grass and escaped to roadsides and other disturbed situations throughout the county. Not native.

***Milium effusum* L.**

Millet Grass

Occasional. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and TAMARACK-SWAMP.

***Muhlenbergia frondosa* (Poir.) Fern.**

Occasional. Diverse open situations.

***Muhlenbergia glomerata* (Willd.) Trin.**

Marsh Wild-timothy

Occasional. FEN, WET-PRAIRIE, WET-MEADOW, RED-MAPLE-SWAMP, and TAMARACK-SWAMP.

***Muhlenbergia mexicana* (L.) Trin.**

Common. FEN and RED-MAPLE-SWAMP.

***Muhlenbergia racemosa* (Michaux) BSP.**

Current status unknown. First collected by the Haneses in 1944 from dry soil along a RR right-of-way in section 21 of Schoolcraft Tp. Adventive.

***Muhlenbergia richardsonis* (Trin.) Rydb.**

Current status uncertain, very rare if still extant. Known only from "dense clumps," often on ant mounds, in a streamside FEN two mi. E of Alamo in section 24 of Alamo Tp. First collected at this site by the Haneses in 1938 (Hanes 1939). Reportedly persisted at least until the early 1970s (R. W. Phippen pers. comm.). I have not been able to find it in several years of searching this relatively small site (1996–2002). Much of the formerly species-rich FEN meadow is now overgrown with SHRUB-CARR. Several other prairie FEN species, including *Arnoglossum plantagineum* and *Sorghastrum nutans* have also disappeared from this site in the last 20 years or so (R. W. Phippen pers. comm. 1997).

***Muhlenbergia schreberi* J. F. Gmelin**

Nimblewill

Current status uncertain. Known from diverse terrestrial situations.

***Muhlenbergia sylvatica* Torrey**

Current status unknown. Collected by the Haneses from "swamps" around Gourdneck, Hampton, Paw Paw, and Sugarloaf Lakes, and "near Spring Brook."

***Muhlenbergia tenuiflora* (Willd.) BSP.**

Current status uncertain. Collected by the Haneses from a "hillside" in section 32 of Texas Tp., and by F. W. Rapp from his SUGAR-MAPLE-FOREST E of Vicksburg.

***Oryzopsis racemosa* (Sm.) Hitchc.**

Black-fruited Rice Grass

Current status uncertain. Collected by the Haneses from "hilly woods" E of Galesburg near the Kalamazoo River where it was "scarce," and from the N border of section 25 of Charleston Tp.

***Panicum boreale* Nash**

Northern Panic Grass

Current status unknown. Collected by the Haneses from moist to wet depressions near Sugarloaf Lake.

***Panicum calliophyllum* Ashe**

Current status uncertain. Not recently collected or observed, and clearly very rare if still extant. Collected by the Haneses from an "oak and hickory wood" in section 18 of Richland Tp. (Hanes 1939).

Hanes #1067, collected in section 19 of Richland Tp. (possibly at Spring Brook) on 5 August 1937, may also be this species.

***Panicum capillare* L.**

Witch Grass

Current status uncertain. Fields, lawns, and roadsides.

***Panicum clandestinum* L.**

Current status uncertain. Moist to wet depressions in OAK-HARDWOOD-FOREST, and openings in HARDWOOD-SWAMP and RED-MAPLE-SWAMP.

***Panicum columbianum* Scribner**

Rare. OAK-HARDWOOD-FOREST, sandy old fields, and open dry situations upslope from COASTAL-PLAIN-MARSH. Included in the Haneses' (1947) *P. tsugetorum* and *P. villosissimum*.

Panicum commutatum* Schultes *Hanes: P. ashei

Current status unknown. Collected by the Haneses from dry sandy soil near Goose and Sugarloaf Lakes.

***Panicum depauperatum* Muhl.**

Starved Panic Grass

Occasional. Disturbed BLACK-OAK-BARREN and other dry sandy situations in the western half of the county.

***Panicum dichotomiflorum* Michaux**

Fall Panicum

Occasional. Lawns, fields, and roadsides. Weedy.

***Panicum dichotomum* L.**

Forked Panic Grass

Occasional. OAK-HARDWOOD-FOREST.

***Panicum flexile* (Gatt.) Scribner**

Wiry Panic Grass

Occasional. Marly lakeside FEN, especially near spring discharge areas.

***Panicum implicatum* Britton**

Occasional. Lakeshores and a diversity of other open situations.

***Panicum latifolium* L.**

Current status unknown. OAK-HARDWOOD-FOREST.

***Panicum leibergii* (Vasey) Scribner**

Very rare. Collected by L. A. Kenoyer in June 1926 from WET-PRAIRIE along the Michigan Central RR right-of-way near the WMU campus. Observed in 1980 growing at the top of a hill on the S side of Stadium Dr., a quarter of a mile W of Howard St. in dry-mesic soil near the Kenoyer collection site and along the former right-of-way of the same RR. Richard Brewer (1965) reports that this species was a common component of a former old growth WET-PRAIRIE in the aforementioned right-of-way that was mostly covered by fill in 1963–1964 during the “improvement” of Stadium Drive (see Brewer 1965). Also reported by Brewer (1984) from somewhat further W along the same former RR right-of-way, more or less across the street from the present intersection of Stadium Dr. and Stadium Drive. These sites are/were remnants of a once extensive prairie, oak savanna, and wetland mosaic along the right-of-way of the former MI Central RR more or less along Stadium Dr. through the WMU campus and continuing to the west. I located a few plants in 1996 growing in wet-mesic TERRESTRIAL-PRAIRIE/BUR-OAK-SAVANNA E of the intersection of Stadium Dr. and Winchell Rd., on the N side of Stadium Dr. near where several large billboards stand (pers. obs. 2000). Not known elsewhere in the county.

***Panicum lindheimeri* Nash**

Current status unknown. Collected by the Haneses from sandy soil in "woods" and "open ground," mostly in the vicinity of the Sugarloaf Lakes.

***Panicum linearifolium* Britton**

Slender-leaved Panic Grass

Current status unknown. Once "infrequent" in "sandy fields" NE of Goose Lake and in BLACK-OAK-BARREN (Hanes & Hanes 1947). Voss (1972) refers the Haneses' *P. bicknellii* to this species (Hanes 1943).

***Panicum meridionale* Ashe**

Matted Panic Grass

Current status uncertain. Wet sandy situations in the western half of the county. Includes the Haneses' (1947) *P. albemarlense*.

***Panicum miliaceum* L.**

Proso; Broomcorn Millet

Current status unknown. Known only from collections made by the Haneses near the Schoolcraft dump in "waste places." First collected in 1937. Not native.

***Panicum oligosanthos* Schultes**

Current status uncertain. Dry sandy soil of former BLACK-OAK-BARREN and WHITE-OAK-SAVANNA, OAK-HARDWOOD-FOREST, and old fields.

***Panicum perlongum* Nash**

Current status unknown. Reported by the Haneses from RR right-of-ways, and collected by L. H. Harvey 15 June 1940 1 mi. W of Kalamazoo in "sandy outwash" (MICH). Last collected by the Haneses 26 June 1945 along a RR right-of-way through section 39 of Portage Tp. Probably not native.

***Panicum philadelphicum* Trin.**

Current status uncertain, very rare if still extant. Known from the E side of Austin Lake near the former Austin Shores Golf Course in an area then dominated by COASTAL-PLAIN-MARSH, open OAK-HARDWOOD-FOREST, sandy WET-PRAIRIE, and oak savanna. The habitat in which the collection was made is unclear. Also collected from the border of Patton's Marsh 1.5 mi. NW of Schoolcraft (on Prairie Ronde), the border of the "Island" Marsh W of Schoolcraft (on Prairie Ronde), and from near Sugarloaf Lake. Last collected by the Haneses 22 September 1953 on the border of Patton's Marsh. All of these sites are on or very near Prairie Ronde and Gourdneck Prairie. Probably once a component of TERRESTRIAL-PRAIRIE and associated oak savanna.

***Panicum praecocius* Hitchc. & Chase**

Current status unknown. Collected by the Haneses from section 18 of Richland Tp. and from near Mud Lake in Pavilion Tp.

***Panicum rigidulum* Nees**

Current status unknown. Collected by F. W. Rapp from along a RR right-of-way 1 mi. E of Vicksburg on 11 September 1945. Not in Hanes & Hanes (1947).

***Panicum sphaerocarpon* Ell.**

Current status unknown. Open, dry, sandy situations.

***Panicum virgatum* L.**

Switch Grass

Occasional. RR rights-of-way, roadsides, FEN, WET-MEADOW, WET-PRAIRIE, TERRESTRIAL-PRAIRIE, and elsewhere, generally near open lakeshores.

Paspalum ciliatifolium Michaux **Hanes:** *P. pubescens*

Pubescent Paspalum

Current status uncertain. Dry, sandy, open situations, and BLACK-OAK-BARREN.

Phalaris arundinacea L.

Reed Canary Grass

Common. Wet old fields, disturbed WET-PRAIRIE, WET-MEADOW, FEN, HARDWOOD-SWAMP, and SHRUB-SWAMP. Usually a good indicator of disturbance such as grazing. Native and introduced plants occur here.

Phleum pratense L.

Timothy

Common. Roadsides, old fields, and other disturbed situations. Widely established.

Phragmites australis (Cav.) Steudel **Hanes:** *P. communis*

Reed

Common. Roadside ditches and lakeshores. Readily invades disturbed WET-MEADOW, FEN, BOG, EM-MARSH, SHRUB-CARR, and WET-PRAIRIE. Native and introduced plants occur here.

Poa alsodes Gray

Grove Meadow Grass

Current status unknown. Collected by the Haneses from a "swamp border" 1 mi. N of Goose Lake, and from two "wooded swamps" in Alamo Tp.

Poa annua L.

Annual Bluegrass

Common. Lawns and roadsides.

Poa bulbosa L.

Rare. Lawns in the Knollwood area of Kalamazoo City, just W of the WMU campus. First observed by the author in the lawn of Oak Forest Apartments in 1996. Not native. Not in Hanes & Hanes (1947).

Poa compressa L.

Canada Bluegrass

Common. Dry lawns and old fields. Widely established.

Poa languida Hitchc.

Weak Grass

Current status uncertain. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

Poa nemoralis L.

Wood Bluegrass

Current status unknown. Collected by the Haneses from a lawn in the village of Schoolcraft. Not native.

Poa paludigena Fern. & Wieg.

Swamp Poa

Rare. Usually on small hummocks of moss in open RED-MAPLE-SWAMP, and in rich HARDWOOD-SWAMP near FEN and BOG (Hanes 1938). Easily overlooked.

Poa palustris L.

Fowl Meadow Grass

Occasional. WET-MEADOW and FEN.

Poa pratensis L.

Kentucky Bluegrass

Common. Lawns and other open situations. Not native.

***Poa sylvestris* Gray**

Woodgrass

Current status uncertain. SUGAR-MAPLE-FOREST.

***Poa trivialis* L.**

Current status unknown. Collected by the Haneses from the E shore of Long Lake, Pavilion Tp. Not native.

Puccinellia pallida* (Torrey) Clausen **Hanes:** *Glyceria pallida

Pale Manna Grass

Occasional. RED-MAPLE-SWAMP, EM-MARSH, and FEN.

***Schizachne purpurascens* (Torrey) Swallen**

False Melic

Current status unknown. Collected by the Haneses from swampy depressions in forest throughout.

***Sclerochloa dura* (L.) P. Beauv.**

Common Hardgrass

Locally established. Known only from a collection made by Richard K. Rabeler in 1999 at the Kalamazoo County Fairgrounds (MICH). Not in Hanes & Hanes (1947).

***Secale cereale* L.**

Rye

Rare. Roadsides and RR rights-of-way. Not native.

***Setaria glauca* (L.) Beauv.**

Yellow Foxtail

Occasional. Fields, roadsides, and RR rights-of-way. Included in the Haneses' (1947) *S. lutescens*. Not native.***Setaria italica* (L.) Beauv.**

Foxtail or Hungarian Millet

Occasional. Not in Hanes & Hanes (1947), but this taxon may have been included in their concept of *S. lutescens*. Not native.***Setaria verticillata* (L.) Beauv.**

Bristly Foxtail

Occasional. RR rights-of-way and other disturbed open situations. Not native.

***Setaria viridis* (L.) Beauv.**

Green Foxtail

Occasional. Fields, gardens, and other disturbed situations. Not native.

***Sorghastrum nutans* (L.) Nash**

Indian Grass

Occasional. TERRESTRIAL-PRAIRIE, WHITE-OAK-OPENING, and BLACK-OAK-BARREN. Rare in FEN meadow and other relatively wet situations. Essentially a dry-mesic to dry TERRESTRIAL-PRAIRIE and oak savanna generalist.

***Sorghum halepense* (L.) Pers.**

Johnson Grass

Rare. Roadsides, RR rights-of-way, and old fields. A perennial, otherwise difficult to discern from *S. sudanense* which is an annual. Rarely escaped.***Sorghum sudanense* (Piper) Stapf**Rarely escaped. Disturbed situations (see *S. halepense*). Not in Hanes & Hanes (1947).

Spartina pectinata Link

Cordgrass

Occasional to common. FEN, WET-MEADOW, and WET-PRAIRIE. Declining due to degradation and loss of wetland habitat.

Sphenopholis intermedia (Rydb.) Rydb.

Slender Wedge Grass

Occasional. Moist to wet depressions in HARDWOOD-SWAMP and RED-MAPLE-SWAMP.

Sphenopholis nitida (Biehler) Scribner

Current status unknown. OAK-HARDWOOD-FOREST.

Sphenopholis obtusata (Michaux) Scribner

Early Bunch Grass

Current status uncertain. Moist sandy situations in the western half of the county.

Sporobolus asper (Michaux) Kunth

Long-leaved Rush Grass

Rare. RR rights-of-way in the south half of the county (Hermann 1936). Easily overlooked due to its late-season development. Probably adventive.

Sporobolus cryptandrus (Torrey) Gray

Sand Dropseed

Occasional. Dry sandy soil along roadsides and in old fields.

Sporobolus heterolepis (Gray) Gray

Prairie Dropseed

Very rare. Reported by the Haneses only from a collection made by L. A. Kenoyer from a "Bridle Path SW of Kalamazoo" (along the right-of-way of the former MI Central RR, est. in 1847). Collected in 1940 from a "bank" along Stadium Dr., probably near its current intersection with Howard St., and not far from the location of the L. A. Kenoyer collection. The Haneses were apparently not aware of the latter collection. At Whitman Lake in Fort Custer *Sporobolus heterolepis* is occasional in FEN. Probably occurs elsewhere in the county in FEN. Easily overlooked.

Sporobolus neglectus NashCurrent status unknown. Collected by the Haneses from dry old fields in the NE $\frac{1}{4}$ of the county.*Sporobolus vaginiflorus* (Torrey) Wood

Occasional. Dry old fields and roadsides.

Stipa avenacea L.

Black Oat Grass

Current status uncertain. BLACK-OAK-BARREN, OAK-HARDWOOD-FOREST, and dry old fields.

Stipa comata Trin. & Rupr.

Extinct. First collected by the Haneses 26 September 1936 from dry soil along a RR right-of-way W of Indian Lake (Hanes 1938). Again collected here on 27 July 1947 by W. B. Drew (MSC). Not since collected. Probably adventive.

Stipa spartea Trin.

Porcupine Grass

Current status uncertain, very rare if still extant. Collected by the Haneses from the western half of the county along former dry-mesic prairie roadsides and RR rights-of-way, in remnant TERRESTRIAL-PRAIRIE and adjacent oak savanna. No longer known from any former sites, but there is a small chance that a few plants may persist in unsearched areas in the western half of the county. This

grass was once relatively common, and was at least locally an important component of TERRESTRIAL-PRAIRIE and oak savanna.

Tridens flavus* (L.) Hitchc. Hanes: *Triodia flava

Purpletop

Occasional. Dry to moist open roadsides. Locally established.

***Triticum aestivum* L.**

Wheat

Common. Roadsides and RR rights-of-way. Not native.

***Zizania aquatica* L.**

Wild-rice

Rare. EM-MARSH. There are two varieties in Kalamazoo County. The var. *aquatica* is taller and more widely distributed than var. *angustifolia* which is rather local and nearly restricted to the lake-side/streamside margins of FEN. The var. *angustifolia* is especially frequent in the Gourdneck State Game Area.

CYPERACEAE

Sedge Family

This is a large and diverse family in Kalamazoo County. Several species otherwise unfamiliar to me are reported here based only upon annotations made to herbarium specimens by A. A. Reznicek and E. G. Voss (Voss 1996, 1985, 1972). The Haneses were diligent students of the genus *Carex*. They collected most of the species listed below. Their work with the genus benefited much from the tutelage of Frederick J. Hermann (Voss & Reznicek 1981). Most of the native *Carex* spp. are represented by relatively few herbarium specimens. I have found that many of these little-collected species are actually relatively common in the field. Clearly, many are overlooked or ignored by plant collectors.

***Bulbostylis capillaris* (L.) C. B. Clarke**

Hair Sedge

Occasional. Dry sandy old fields and BLACK-OAK-BARREN, primarily in the western half of the county (Hanes 1945b).

***Carex aggregata* Mack.**

Current status unknown. Collected by the Haneses from lawns in the village of Schoolcraft (Hanes 1938). Possibly adventive.

***Carex alata* Torrey**

Occasional. WET-MEADOW, FEN, and openings in wet TAMARACK-SWAMP, mostly in the south half of the county.

***Carex albolutescens* Schw.**

Very rare. RED-MAPLE-SWAMP in the south half of the county. Only one extant occurrence is known, but several sites reported by the Haneses remain intact and unsearched. Not known to be extant elsewhere in Michigan (Hanes 1938).

***Carex albursina* Sheldon**

Current status unknown. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Carex alopecoidea* Tuckerman**

Current status uncertain. Collected by the Haneses from "marshy meadows E of Augusta near the Kalamazoo River" and "the steep bank of a drain" in Wakeshma Tp. Recently reported only from FLOODPLAIN-FOREST along the Kalamazoo River at the Augusta Floodplain Forest Preserve where it was "infrequent" (Meagher & Tonsor 1992).

***Carex amphibola* Steudel**

Current status unknown. Near the Kalamazoo River in FLOODPLAIN-FOREST, and SUGAR-

MAPLE-FOREST on nearby levees (Meagher & Tonsor 1992). Also reported from OAK-HARDWOOD-FOREST.

Carex annectens (Bickn.) Bickn.

Current status uncertain. Known from a collection made by the Haneses (accompanied by F. J. Hermann) from a "swamp border," N of Vicksburg. Recently (1994) collected by P. J. Higman (MNFI) from an "open dry field" at Fort Custer. Probably overlooked.

Carex aquatilis Wahl. **Hanes:** *C. substricta*, & *C. haydenii*

Occasional. WET-MEADOW and FEN. The Haneses' *C. haydenii* has been placed here by F. J. Hermann.

Carex arctata Boott

Occasional. SUGAR-MAPLE-FOREST, HARDWOOD-SWAMP, and RED-MAPLE-SWAMP.

Carex argyrantha Tuckerman

Current status uncertain. Collected in 1947 by F. W. Rapp on a sandy wooded hill near a marsh in the SE $\frac{1}{4}$, SE $\frac{1}{4}$, section 34, Schoolcraft Tp. This species usually has a more N range (Hanes 1950). Not in Hanes & Hanes (1947).

Carex artitecta Mack.

Current status unknown. Collected by the Haneses from terrestrial forests bordering wetlands in the southwest quarter of the county.

Carex atherodes Sprengel

Current status uncertain. WET-MEADOW and EM-MARSH.

Carex atlantica Bailey **Hanes:** *C. incompta*

Current status uncertain. Shrubby lakeside BOG in the SW $\frac{1}{4}$ of the county.

Carex aurea Nutt.

Current status uncertain. Collected by the Haneses from a "meadow" 1 mi. SW of Scotts.

Carex bebbii (Bailey) Fern.

Occasional. WET-MEADOW, FEN, and WET-PRAIRIE.

Carex bicknellii Britton

Rare. Collected by the Haneses from along RR rights-of-way through former TERRESTRIAL-PRAIRIE, and in oak savanna. Now rare in some of the same places. The only sizeable populations that persist are at Harris Prairie (section 2 of Oshtemo Tp.), and near the former right-of-way of the MI Central RR at the NW corner of the intersection of Drake Rd. and Stadium Dr. (a droughty dry-mesic former WHITE-OAK-SAVANNA on the former edge of Genesee Prairie). Probably once a common component of TERRESTRIAL-PRAIRIE and oak savanna.

Carex blanda Dewey

Current status unknown. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and low moist areas in SUGAR-MAPLE-FOREST.

Carex brevior (Dewey) Mack.

Current status unknown. Collected by the Haneses from OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST in the south half of the county.

Carex bromoides Willd.

Occasional. Swamp forests, usually in mucky wet depressions.

Carex brunnescens (Pers.) Poiret

Occasional. BOG.

***Carex buxbaumii* Wahl.**

Occasional. FEN. Once also a component of WET-PRAIRIE, but no longer known from this habitat.

***Carex canescens* L.**

Occasional. Open HARDWOOD-SWAMP, RED-MAPLE-SWAMP, WET-MEADOW, and BOG.

***Carex careyana* Dewey**

Current status unknown. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and SUGAR-MAPLE-FOREST.

Carex cephalantha* (Bailey) Bickn. **Hanes:** *C. laricina

Current status unknown. Collected by the Haneses from BOG and FEN in the south half of the county.

***Carex cephaloidea* (Dewey) Dewey**

Thin-leaved Sedge

Occasional. SUGAR-MAPLE-FOREST.

***Carex cephalophora* Willd.**

Oval-headed Sedge

Occasional. SUGAR-MAPLE-FOREST and swamp forests.

***Carex communis* Bailey**

Current status unknown. Collected by the Haneses from SUGAR-MAPLE-FOREST.

***Carex comosa* Boott**

Bristly Sedge

Occasional. Borders of lakes and streams, and TAMARACK-SWAMP.

***Carex conoidea* Willd.**

Current status uncertain. Collected by the Haneses from "a moist grassy meadow on the border of a tamarack wood, one mi. SW of Scotts," and from along a RR right-of-way in section 17 of Pavilion Tp. Perhaps once an oak savanna/prairie species.

***Carex convoluta* Mack.**

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Carex crinita* Lam.**

Occasional. Mucky depressions in HARDWOOD-SWAMP, RED-MAPLE-SWAMP, FLOOD-PLAIN-FOREST, and TAMARACK-SWAMP.

***Carex cristatella* Britton**

Occasional. SUGAR-MAPLE-FOREST, HARDWOOD-SWAMP, RED-MAPLE-SWAMP, FLOODPLAIN-FOREST, and in a diversity of other relatively shaded and moist situations.

***Carex cryptolepis* Mack.**

Rare. On the borders of sandy lakes and ponds, often in COASTAL-PLAINS-MARSH. Declining, apparently due to development along sandy lakeshores and manipulation of water levels.

***Carex debilis* Michaux**

Current status unknown. Collected by the Haneses from SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST, usually near wetlands.

***Carex deweyana* Schw.**

Current status uncertain. Collected by the Haneses "from the N side of Parker's woods . . . NW of Kalamazoo."

Carex diandra Schrank

Current status unknown. Collected by the Haneses from along "boggy shores" of lakes and creeks.

Carex digitalis Willd.

Current status unknown. Collected by the Haneses from "moist woods."

Carex disperma Dewey

Rare. Wet depressions in HARDWOOD-SWAMP and RED-MAPLE-SWAMP.

Carex emmonsii Dewey

Current status uncertain. Perhaps a former oak savanna species. Herbarium specimens are mostly from relatively open and sandy, wet substrates.

Carex emoryi Dewey

Current status uncertain. Collected by the Haneses from several widely separated sites where it was "rare in marshy meadows" (Hermann 1941).

Carex festucacea Willd.

Current status uncertain; very rare if still extant. Collected by Father P. E. Herbert (Notre Dame) 21 June 1952 from a "marsh" "¼ mile E of the Vicksburg Depot." Not in Hanes & Hanes (1947).

Carex flava L.

Current status uncertain. Collected by the Haneses from "a grassy meadow bordering a swampy wood E of Mud (Veley) Lake, Alamo Tp." (probably a FEN).

Carex foenea Willd. **Hanes:** *C. siccata*

Current status uncertain. Collected by the Haneses only from "grassy banks along the roadside near the Neasmith RR crossing 4 mi. E of Schoolcraft." This is an area of dry-mesic to mesic oak savanna bordering former TERRESTRIAL-PRAIRIE. A few prairie and savanna plants persist at the site in fencerows and along the RR right-of-way (pers. obs. 1996).

Carex frankii Kunth

Very rare. Rich HARDWOOD-SWAMP in the SE ¼ of the county, usually near streams (Hanes 1941).

Carex gracilescens Steudel

Current status unknown. Collected by the Haneses from rich SUGAR-MAPLE-FOREST in Prairie Ronde Tp.

Carex gracillima Schw.

Occasional. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, SUGAR-MAPLE-FOREST, and FLOODPLAIN-FOREST.

Carex granularis Willd.

Current status unknown. RED-MAPLE-SWAMP and WET-MEADOW. Includes the Haneses' (1947) *C. haleana*.

Carex grayi Carey

Occasional. HARDWOOD-SWAMP and RED-MAPLE-SWAMP.

Carex hirsutella Mack.

Current status uncertain. Collected by the Haneses from the "border of a swamp NE of Goose Lake."

Carex hirtifolia Mack.

Current status unknown. Rich HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and SUGAR-MAPLE-FOREST.

Carex hitchcockiana Dewey

Current status unknown. SUGAR-MAPLE-FOREST.

Carex howei Mack.

Current status uncertain. Collected by the Haneses from "low woods" on the SE side of Goose Lake, and $\frac{3}{4}$ mi. NE of Goose Lake "often in water." Also known from near the portion of Goose Lake in Berrien Co. One site the Haneses called "Ernest Newman's low woods" is near Goose Lake in section 32 of Prairie Ronde Tp. Last collected in 1938 at this station. The Kalamazoo County and Berrien County collections are the only ones known from Michigan. The Kalamazoo County specimens are not wholly typical of this species (see Voss 1972).

Carex hystericina Willd. **Hanes:** *C. hystericina*

Porcupine Sedge

Occasional. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, WET-MEADOW, and SUGAR-MAPLE-FOREST.

Carex interior Bailey

Current status uncertain. EM-MARSH, COASTAL-PLAIN-MARSH, and other wet, sandy situations.

Carex intumescens Rudge

Occasional. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and in depressions in other kinds of forest.

Carex jamesii Schw.

Very rare. Rich, (usually) old-growth SUGAR-MAPLE-FOREST. Typically in areas where there has been little recent canopy disturbance such as beneath large old *Quercus rubra*.

Carex lacustris Willd.

Occasional. WET-MEADOW. Also found in ditches, alongside BOG moats in SHRUB-SWAMP, and bordering rivers and streams. This is reportedly the dominant *Carex* in WET-MEADOW and EM-MARSH along the Kalamazoo River (Meagher & Tonsor 1992).

Carex laevivaginata (Kue.) Mack.

Occasional. Forming caespitose clumps in EM-MARSH, open swamp forests, and FEN. Especially frequent near streams.

Carex lanuginosa Michaux

Current status unknown. EM-MARSH and lakeshores.

Carex lasiocarpa Ehrh.

Occasional. FEN, BOG, and WET-MEADOW.

Carex laxiculmis Schw.

Occasional. Collected by the Haneses from "woods."

Carex laxiflora Lam.

Current status uncertain. Collected by the Haneses from low SUGAR-MAPLE-FOREST. Reportedly "infrequent" in "marsh" near the Kalamazoo River at the Augusta Floodplain Preserve (Meagher & Tonsor 1992).

Carex leavenworthii Dewey

Current status unknown. Collected by the Haneses from lawns and "gravely sandy soil" in Schoolcraft and Kalamazoo Tps. (Hanes 1939).

Carex leptalea Wahl.

Current status unknown. FEN.

Carex leptoneuria Fern.

Current status unknown. Collected by the Haneses from SUGAR-MAPLE-FOREST in the E ½ of the county. Last collected in 1941.

Carex limosa L.

Occasional. BOG in the S ½ of the county.

Carex longii Mack.

Rare. Shrubby seepage BOG (large areas are dominated by SHRUB-CARR) surrounding Mud Lake (Portage Tp.), and in similar acidic habitats including RED-MAPLE-SWAMP elsewhere in the S ½ of the county (Hanes 1939).

Carex lupuliformis Dewey

Current status uncertain, very rare if still extant. Known with certainty only from collections made on 26, 29, and 31 of August 1950 from the SE ¼ of the SE ¼ of section 13 of Brady Tp. on the S and E sides of the F. W. Rapp woods. No plants were found here in the several visits I made to this site between 1996–1999. This forest has been partly destroyed by horse pasture and other development (pers. obs.). Reported by Meagher & Tonsor (1992) from wet muck in FLOODPLAIN-Forest near the Kalamazoo River, but this purported specimen is not at WMU, KBSMS, MICH, or MSC, and may have been re-identified (A. Reznicek pers. comm.). Not in Hanes & Hanes (1947).

Carex lupulina Willd.

Occasional. Swamp forests and WET-MEADOW.

Carex lurida Wahl.

Current status unknown. Once “infrequent” in “marshes” and “tamarack swamps” (Hanes & Hanes 1947).

Carex mesochorea Mack.

Current status unknown. Known from a single Hanes collection made from along a Kalamazoo street on 19 May 1949 (MICH). Not native. Not in Hanes & Hanes (1947).

Carex molesta Mack.

Current status uncertain. Collected by the Haneses from near the Kalamazoo River in “moist soil near the Allied Paper Mills,” from a “marshy meadow E of Augusta,” and from “somewhat high ground . . . W of Galesburg.”

Carex muhlenbergii Willd.

Occasional. BLACK-OAK-BARREN, and quite generally in open, dry, sandy ecotone.

Carex muskingumensis Schw.

Current status uncertain. Known from a single specimen collected by L. A. Kenoyer 21 June 1932 “on the border of a ditch in the NW ¼ of section 8 of Pavilion Tp.”

Carex normalis Mack.

Current status unknown. Collected by the Haneses from “dry or semi-moist woodlands,” mostly in the N half of the county.

Carex oligocarpa Willd.

Current status uncertain, very rare if still extant. Collected by the Haneses from the “Sugarlot” (a poorly drained SUGAR-MAPLE-FOREST) immediately W of Schoolcraft in Prairie Ronde Tp. Also collected from E of Kalamazoo by an unknown collector, and by O. A. Farwell in 1920 from section 18 of Charleston Tp. (5558 ½ BLH).

Carex oligosperma Michaux

Occasional. BOG, usually in *Sphagnum* moss.

***Carex pedunculata* Willd.**

Current status unknown. Collected by the Haneses from rich SUGAR-MAPLE-FOREST.

***Carex pensylvanica* Lam.**

Common. Most lightly shaded and sandy terrestrial plant communities. Probably once modal in dry to mesic oak savanna and OAK-HARDWOOD-FOREST (in light shade). Voss (1972) notes that the only Michigan collection seen of var. *digyna* was made by F. W. Rapp (6957 WMU) on 26 May 1941 from the E bank of Sunset Lake.

***Carex plantaginea* Lam.**

Occasional. SUGAR-MAPLE-FOREST and HARDWOOD-SWAMP.

***Carex prairea* Dewey**

Occasional. FEN sedge meadow and WET-MEADOW. Perhaps once a component of WET-PRAIRIE.

***Carex prasina* Wahl.**

Current status unknown. Collected by the Haneses from SUGAR-MAPLE-FOREST in section 10 of Brady Tp. Last collected in 1942.

***Carex projecta* Mack.**

Current status unknown. Collected by the Haneses from the SE $\frac{1}{4}$ of the county in HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and low SUGAR-MAPLE-FOREST.

***Carex pseudo-cyperus* L.**

Current status unknown. Collected by the Haneses from wet, boggy HARDWOOD-SWAMP, and RED-MAPLE-SWAMP.

***Carex retroflexa* Willd.**

Current status unknown. Collected by the Haneses from the lawn of the M. P. Thomas farm in Schoolcraft on 4 July 1943 (Hanes 1945b). Probably not native.

***Carex retrorsa* Schw.**

Occasional. Swamp forests.

***Carex rosea* Willd.**

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Carex rostrata* Stokes**

Current status unknown. WET-MEADOW and EM-MARSH.

***Carex rugosperma* Mack.**

Current status unknown. Sandy ecotone near wetlands, mostly in the W half of the county. Includes the Haneses' (1947) *C. tonsa*.

***Carex sartwellii* Dewey**

Rare. Collected by the Haneses from open swampy habitats (mostly FEN) primarily in the SW $\frac{1}{4}$ of the county. Frequently associated with ponds on Prairie Ronde.

***Carex scabrata* Schw.**

Current status uncertain. WET-MEADOW and spring discharge areas in FEN.

***Carex scoparia* Willd.**

Current status uncertain. Mesic depressions in BLACK-OAK-BARREN, COASTAL-PLAIN-MARSH, and near sandy lakeshores, mostly in the SW $\frac{1}{4}$ of the county.

A hybrid, *C. suberecta* \times *C. scoparia* was found on 23 June 1992 by A. A. Reznicek on the S side of VW Ave. at the center of section 14 of Schoolcraft Tp.

Carex seorsa Howe

Current status uncertain. Collected by the Haneses from a wetland border near Vicksburg. Last reported here by Kim Chapman in 1980 (K. Chapman, MNFI Site Survey Report 1980). Some associates in 1980 included *Acer rubrum*, *Ilex verticillata*, *Maianthemum canadense*, *Prunus serotina*, *Quercus rubra*, and *Vaccinium macrocarpon*.

Carex sparganioides Willd.

Current status unknown. Rich, relatively wet SUGAR-MAPLE-FOREST.

Carex sterilis Willd.

Occasional. FEN, WET-MEADOW, and WET-PRAIRIE.

Carex stipata Willd.

Awl-fruited Sedge

Current status unknown. Reported by the Haneses to be "frequent" in the SW ¼ of the county in "moist ground."

Carex straminea Willd. **Hanes:** *C. richii*

Very rare. Collected by A. A. Reznick at the edge of a *Quercus palustris*, *Acer rubrum* woods bordering a highbush blueberry thicket SE of the junction of 23rd St. and U Ave. 1.5 mi. N of Vicksburg at the center of the N edge of section 12 of Schoolcraft Tp. on 23 June 1992, and from a wet open maple woods at the edge of a shrubby BOG. Apparently limited to the immediate vicinity of Schoolcraft Tp. This species is at the northernmost edge of its range in Michigan.

Carex stricta Lam.

Tussock Sedge

Common. FEN, WET-MEADOW, SHRUB-CARR, and similar wet, often somewhat disturbed situations (probably once including WET-PRAIRIE). Both the var. *strictior* and the much rarer var. *stricta* are known from Kalamazoo County. The status of var. *stricta* is unknown. A known host plant for larvae of the federally endangered Mitchell's Satyr Butterfly (*Neonympha mitchellii mitchellii*) which is known from several Kalamazoo County fens.

Carex suberecta (Olney) Britton

Current status unknown. Collected by F. W. Rapp from an EM-MARSH one mi. W of Vicksburg. Known to hybridize with *C. scoparia* (see *C. scoparia*).

Carex swanii (Fern.) Mack.

Occasional. OAK-HARDWOOD-FOREST and shady situations in BLACK-OAK-BARREN.

Carex tenera Dewey

Current status unknown. Collected by the Haneses from moist open ground including roadsides, old fields, and forest openings. Perhaps once a savanna/prairie species.

Carex tetanica Schk.

Current status unknown. Collected by the Haneses from dry to moist situations including RR rights-of-way, WET-MEADOW, and FEN. Perhaps once a savanna/prairie species. Includes the Haneses' (1947) *C. meadii*.

Carex tribuloides Wahl.

Current status uncertain. HARDWOOD-SWAMP and wet open ground along lakeshores and creeks.

Carex trisperma Dewey

Occasional. BOG, FEN, and RED-MAPLE-SWAMP.

***Carex tuckermanii* Dewey**

Current status unknown. Collected by the Haneses from WET-MEADOW and the edge of small ponds in the S half of the county.

***Carex umbellata* Willd.**

Current status uncertain, very rare if still extant. Collected by the Haneses from 3 mi. E of Schoolcraft near a RR right-of-way (Hanes 1940).

***Carex vesicaria* L.**

Current status unknown. Collected by the Haneses from a few widely scattered locations in the S ½ of the county (but mostly without habitat data). One collection was from the site of an ephemeral pond.

***Carex virescens* Willd.**

Current status uncertain, very rare if still extant. Collected by the Haneses from a "low meadow . . . in section 31 of Wakeshma Tp." Last collected in 1939.

***Carex viridula* Michaux**

Occasional. COASTAL-PLAIN-MARSH and sandy lakeshores in the W ½ of the county. Declining due to lakeshore development.

***Carex vulpinoidea* Michaux**

Common. Wet roadsides, wet old fields, HARDWOOD-SWAMP, WET-MEADOW, and SHRUB-SWAMP.

***Carex woodii* Dewey**

Current status uncertain. Wet SUGAR-MAPLE-FOREST, HARDWOOD-SWAMP, and RED-MAPLE-SWAMP.

***Cladium marsicoides* (Muhl.) Torrey**

Twig-rush

Occasional. BOG, FEN, and EM-MARSH, mostly in the SW ¼ of the county.

***Cyperus diandrus* Torrey**

Rare. FEN, usually near water.

***Cyperus engelmannii* Steudel**

Current status unknown. Reported by the Haneses from ponds and lakeshores, mostly in the W half of the county.

***Cyperus erythrorhizos* Muhl.**

Current status unknown. Collected by the Haneses from WET-MEADOW near water.

***Cyperus esculentus* L.**

Chufa

Common. Open, wet, disturbed ground.

***Cyperus filiculmis* Vahl.**

Occasional. Dry, sandy old fields, and disturbed BLACK-OAK-BARREN. Several specimens collected by the author in section 24 of Alamo Tp. appear intermediate between this species and *C. schweinitzii* Torrey, supporting the suggestion by Voss (1972) that a hybrid complex including these two species may exist in Michigan.

***Cyperus flavescens* L.**

Current status uncertain, very rare if still extant. Collected by the Haneses from WET-MEADOW near Flowerfield Creek in section 36 of Prairie Ronde Tp.

***Cyperus odoratus* L.**

Occasional. Sandy lakeshores, often in COASTAL-PLAIN-MARSH.

Cyperus rivularis Kunth

Shining Cyperus

Occasional. Usually in sandy substrates near disturbed lakeshores, and in COASTAL-PLAIN-MARSH.

Cyperus schweinitzii TorreyOccasional. Disturbed BLACK-OAK-BARREN, primarily in the NW ¼ of the county. Always in sand. Apparent hybrids with *C. filiculmis* have been found in section 24 of Alamo Tp. (see *C. filiculmis*).*Cyperus strigosus* L.

Occasional. Moist to wet open disturbed situations, usually near water.

Dulichium arundinaceum (L.) Britton

Three-way sedge

Occasional. EM-MARSH, WET-MEADOW, BOG, and FEN.

Eleocharis acicularis (L.) R. & S.

Current status unknown. EM-MARSH.

Eleocharis elliptica KunthCurrent status uncertain. EM-MARSH and FEN. Includes the Haneses' (1947) *E. compressa*.*Eleocharis engelmannii* Steudel

Current status uncertain, very rare if still extant. Once "rare" in EM-MARSH of small ponds in the S half of the county (Hanes & Hanes 1947). Most former sites were associated with marshes on Prairie Ronde. Decline is due to draining and past or present cultivation of most small wet depressions on Prairie Ronde.

Eleocharis equisetoides (Ell.) Torrey

Knotted Spike Rush

Rare. EM-MARSH and open muddy lake borders.

Eleocharis erythropoda Steudel **Hanes:** *E. calva*Current status uncertain. Mucky EM-MARSH alongside streams through FEN. Specimens from the Hampton Creek wetlands complex previously identified as *Eleocharis compressa* have been reidentified as this species.*Eleocharis intermedia* Schultes

Current status uncertain. Lake or streamside WET-MEADOW, EM-MARSH, and FEN.

Eleocharis melanocarpa Torrey

Black-fruited Spike Rush

Rare. Sandy lakeshores and COASTAL-PLAIN-MARSH in the W ½ of the county. Declining due to habitat loss.

Eleocharis obtusa (Willd.) Schultes

Current status uncertain. BOG and sandy EM-MARSH.

Eleocharis olivacea Torrey

Occasional. EM-MARSH, SUB-MARSH, and open muddy environments bordering otherwise mostly sandy-bottomed lakes.

Eleocharis pauciflora (Lightf.) Link

Few-flowered Spike Rush

Current status unknown. Collected by the Haneses from along marly lakeshores in FEN, and from EM-MARSH and WET-MEADOW in the W ½ of the county.

***Eleocharis quadrangulata* (Michaux) R. & S.**

Angled Spike Rush

Very rare. Collected by the Haneses from water 0–1 ft. deep (variable from year to year) in sandy, muddy EM-MARSH at Pickerel Lake. Still persisting in 1996. Only population ever known in Kalamazoo County.

***Eleocharis robbinsii* Oakes**

Robbin's Spike Rush

Occasional. EM-MARSH. The "small floating islands . . . carpeted with this species" reported by the Haneses (1947) in Crooked Lake have not been observed by the author in the four years that the lake has been visited. Boat traffic has damaged the shallow wetlands on the W end of this sandy former COASTAL-PLAIN-MARSH.

***Eleocharis rostellata* Torrey**

Current status uncertain. EM-MARSH, FEN, and WET-MEADOW, mostly in the W ½ of the county.

***Eleocharis smallii* Britton**

Current status unknown. Collected by the Haneses from EM-MARSH, mostly in the W ½ of the county.

***Eriophorum angustifolium* Honck.**

Current status uncertain. Collected by the Haneses from the SE ¼ of section 30 of Brady Tp. This site was originally located by F. W. Rapp.

***Eriophorum gracile* W. D. J. Koch**

Current status uncertain. Lakeside BOG. May be limited to the S ½ of the county.

***Eriophorum spissum* Fern.**

Occasional. BOG in the S ½ of the county.

***Eriophorum tenellum* Nutt.**

Very rare. A single population has long been known at LeFevre BOG in section 8 of Climax Tp. (Hanes 1943).

***Eriophorum virginicum* L.**

Tawny Cotton-grass

Occasional throughout in BOG.

***Eriophorum viridi-carinatum* (Engelm.) Fern.**

Occasional. BOG.

***Fimbristylis autumnalis* (L.) R. & S.**

Occasional. COASTAL-PLAIN-MARSH and EM-MARSH on sandy lakeshores in the SW ¼ of the county.

Fuirena squarrosa* Michaux **Hanes:** *F. pumila

Umbrella-grass

Occasional. COASTAL-PLAIN-MARSH, primarily in the SW ¼ of the county. Varies in abundance from year to year depending on water levels.

***Hemicarpha micrantha* (Vahl) Pax**

Rare to common on sandy lakeshores in COASTAL-PLAIN-MARSH, mostly in the W ½ of the county. Varies considerably in abundance depending on water levels. In 1999, a year of exceedingly low water levels, *H. micrantha* was quite rare at Crooked, Pretty, and Eagle Lakes. The previous year when water levels were higher, plants were abundant.

***Psilocarya scirpoides* Torrey**

Bald-rush

Current status uncertain, very rare if still extant. Collected by the Haneses from COASTAL-PLAIN-MARSH at Eagle Lake, Mud Lake, and Pine Island Lake (all in Texas Tp.), Stony Lake (Ross Tp.), and Bishop's Bog (Portage Tp., probably in the COASTAL-PLAIN-MARSH community that borders the bog), and near West Lake. At Bishop's bog, shrub growth now occupies large areas of the former COASTAL-PLAIN-MARSH. All of the other former sites have been altered since the plant was last collected. Some suitable habitat remains at most former sites, but I have not yet found even one plant. The Haneses noted that a smut fungus (*Cintractia psilocaryae*) infests the spikelets. This can be seen on most herbarium specimens.

***Rhynchospora alba* (L.) Vahl**

White Beak Rush

Occasional. BOG and FEN, mostly in the S ½ of the county.

***Rhynchospora capillacea* Torrey**

Hair Beak Rush

Occasional. FEN.

***Rhynchospora capitellata* (Michaux) Vahl**

Clustered Beak Rush

Occasional. WET-MEADOW and COASTAL-PLAIN-MARSH.

***Rhynchospora fusca* (L.) Ait. f.**

Brown Beak Rush

Very rare. Reported by the Haneses (1947) and still persisting in oxidizing peat in a BOG adjoining Bishop's BOG and West Lake BOG, SW of West Lake. This site is now part of the West Lake Nature Preserve. In years of low water levels, plants can be seen from a small floating observation area. The plants are not apparent in high water years (Hanes 1940).

***Rhynchospora macrostachya* Gray**

Horned Beak Rush

Occasional. COASTAL-PLAIN-MARSH and wet depressions in BOG. Mostly in the W ½ of the county.

***Scirpus acutus* Bigelow**

Hardstem Bulrush

Common. FEN and EM-MARSH.

***Scirpus americanus* Pers.**

Threesquare

Occasional. EM-MARSH, WET-MEADOW, and FEN.

***Scirpus atrovirens* Willd.**

Dark-green Bulrush

Common. EM-MARSH, SHRUB-SWAMP, WET-MEADOW, FEN, and WET-PRAIRIE.

***Scirpus cyperinus* (L.) Kunth**

Wool-grass

Occasional. FEN, WET-MEADOW, and BOG. Includes the Haneses' (1947) *S. pedicellatus*.

***Scirpus expansus* Fern.**

Current status unknown. Collected by the Haneses from EM-MARSH of "swamps" and streams (Hanes 1943).

***Scirpus fluviatilis* (Torrey) Gray**

River Bulrush

Current status uncertain. EM-MARSH, mostly in the W ½ of the county.

Scirpus pendulus* Muhl. Hanes: *S. lineatus

Reddish Bulrush

Current status unknown. Collected by the Haneses from alkaline open and wooded wetlands in the E ½ of the county.

***Scirpus smithii* Gray**

Current status uncertain. Sandy EM-MARSH of ponds, mostly in the W ½ of the county (Hermann 1936). Includes the Haneses' (1947) *S. purshianus*.

***Scirpus subterminalis* Torrey**

Water Club Rush

Current status unknown. Collected by the Haneses from SUB-MARSH and EM-MARSH of sand or marl-bottomed lakes mostly in the W ½ of the county.

***Scirpus validus* Vahl**

Softstem Bulrush

Occasional. Lake margins, usually in sandy EM-MARSH.

***Scleria pauciflora* Willd.**

Very rare. First collected in Kalamazoo County by the author in 1997 from an open sandy depression at the edge of a small pond otherwise surrounded by disturbed remnant OB in Alamo Twsp. This site resembles COASTAL-PLAIN-MARSH and is affected by the fluctuating water level of the adjacent pond (pers. obs.). Associated with *Aletris farinosa*, *Lycopodiella inundata*, *Viola palmata*, *Viola lanceolata*, *Viola sagittata*, *Hypericum prolificum*, *Lobelia siphilitica*, *Rhynchospora capitellata*, *Bartonia virginica*, young *Quercus velutina*, and others. Not in Hanes & Hanes (1947).

***Scleria triglomerata* Michaux**

Current status uncertain, very rare if still extant. Collected by the Haneses from sandy WET-PRAIRIE. Most Hanes collections are from the S ½ of the county. Collected at Grand Prairie by the first botanical survey. All known former sites have been destroyed by development, grazing, or are overgrown with shrubs and/or trees.

***Scleria verticillata* Willd.**

Current status uncertain. Marly lakeside depressions in FEN and WET-MEADOW.

ARACEAE**Arum Family*****Acorus calamus* L.**

Sweet-flag; Calamus

Current status uncertain. WET-MEADOW and EM-MARSH, almost exclusively near the Kalamazoo River.

***Arisaema dracontium* (L.) Schott**

Green Dragon; Dragon-root

Rare. FLOODPLAIN-FOREST, HARDWOOD-SWAMP, and rich, relatively wet SUGAR-MAPLE-FOREST.

Arisaema triphyllum* (L.) Schott Hanes: *A. stewardsonii* & *A. atrorubens

Jack-in-the-pulpit; Indian-turnip

Common. SUGAR-MAPLE-FOREST and other rich mesic to wet-mesic forests. More frequent at relatively wet sites such as on outwash than at well-drained sites. The var. *stewardsonii* (in which the tube of the spathe is fluted or corrugated) is less common than the typical variety, but often grows with it. There is much variation in the size and color of the spathe and the plants themselves at most sites. This morphological variation is well documented by the Haneses at the "Island" woods W of Schoolcraft where plants can be found growing in relatively close proximity to one another that exhibit characters (however not convincingly typical) of *A. atrorubens* and *A. triphyllum* var. *stewardsonii*.

Calla palustris L.

Wild Calla; Water-arum

Rare. SHRUB-SWAMP and wet, lightly shaded depressions in BOG. Usually grows in water beneath *Cephalanthus occidentalis* and other water-loving shrubs.*Peltandra virginica* (L.) Schott & Endl.

Arrow-arum; Tuckahoe

Occasional. EM-MARSH, BOG, and other swampy situations.

Symplocarpus foetidus (L.) Nutt.

Skunk-cabbage

Common. RED-MAPLE-SWAMP, HARDWOOD-SWAMP, TAMARACK-SWAMP, FLOOD-PLAIN-FOREST, SHRUB-CARR, ASH-SWAMP, and other wet, mucky situations.

LEMNACEAE

Duckweed Family

Lemna minor L.

Lesser Duckweed

Common. Lakeshores, SHRUB-SWAMP, and floating in open water.

Lemna trisulca L.

Star Duckweed

Common. Same places as *L. minor*, but apparently more common in alkaline situations.*Lemna valdiviana* Phil.Extinct. Collected by the Haneses from near the Fox and Beers Mill in section 26 of Prairie Ronde Tp. in stagnant water associated with *Chara* sp., *L. minor*, *L. trisulca*, and *Wolffia columbiana*. Probably adventive. Last collected by the Haneses on 16 November 1945.*Spirodela polyrhiza* (L.) Schleiden

Greater Duckweed

Common. Wet mud on lakeshores, and floating in EM-MARSH. Usually found in areas sheltered from wave action. Sometimes covers the surface of stagnant ponds.

Wolffia columbiana Karsten

Water Meal

Common. EM-MARSH alongside streams, ponds, BOG moats, and at the edges of rivers and lakes. In similar situations as *W. punctata*, but more common.*Wolffia punctata* Griseb.

Water Meal

Common. In situations like those favored by *S. polyrhiza* and *W. columbiana*.

XYRIDACEAE

Yellow-eyed-grass Family

Xyris difformis Chapman **Hanes:** *X. caroliniana*

Rare. Wet depressions in open BOG at Bishop's Bog in Portage Tp. and LeFevre Bog in Climax Tp. Collected by the Haneses and by the first botanical survey from peaty sand on the S and E shores of Austin Lake in an area once dominated by COASTAL-PLAIN-MARSH, open OAK-HARDWOOD-FOREST, and sandy WET-PRAIRIE and oak savanna (Hermann 1936). No longer known from Austin Lake.

Xyris torta Sm.

Very rare. Collected by the Haneses from COASTAL-PLAIN-MARSH at Eagle, Pretty, and Pine Island Lakes. Only known to persist at Pretty Lake.

ERIOCAULACEAE**Pipewort Family**

Eriocaulon septangulare With.

Pipewort

Occasional. EM-MARSH.

COMMELINACEAE**Spiderwort Family**

Commelina communis L.

Common. RR rights-of-way, waste places, and cultivated fields. Widely established.

Tradescantia ohiensis Raf.

Glaucous Spiderwort

Common. RR rights-of-way, BLACK-OAK-BARREN, and WHITE-OAK-SAVANNA. Usually in sand.

PONTEDERIACEAE**Pickerel-weed Family**

Heteranthera dubia (Jacq.) MacM.

Water Star-grass

Occasional. SUB-MARSH. Often seen flowering in mud along receding lakeshores.

Pontederia cordata L.

Pickerel-weed

Common. SUB-MARSH and EM-MARSH.

JUNCACEAE**Rush Family**

Several species are reported here based upon annotations made to specimens in the WMU Hanes herbarium by E. G. Voss.

Juncus dichotomus var. *platyphyllus* has been reported from Kalamazoo County but is not included here. "A collection by F. J. Hermann and C. R. Hanes from Kalamazoo County (E side of Austin Lake, 9 July 1937, WMU) may be this poorly understood taxon, according to F. J. Hermann" (Voss 1972). The location of the collection was then dominated by COASTAL-PLAIN-MARSH, open OAK-HARDWOOD-FOREST, and sandy WET-PRAIRIE and oak savanna. Most of the area has since been thoroughly destroyed. I have chosen not to separate these specimens from *J. tenuis* and *J. dudleyi* with which *J. dichotomus* is often included, based upon my interpretation of material at MICH and WMU and discussions with A. A. Reznicek and E. G. Voss.

Juncus acuminatus Michaux

Common. SHRUB-SWAMP and EM-MARSH.

Juncus balticus Willd.

Current status uncertain. Mostly in the W½ of the county in EM-MARSH. Usually associated with sandy substrates.

Juncus biflorus Ell.

Current status unknown. Collected by the Haneses from wet, open to thinly wooded meadows, marshes, and lakeshores, on peaty sand "near the bank of Vicksburg Creek," on the E shore of Austin Lake, in section 14 of Oshtemo Tp., and in section 18 of Texas Tp. (Hanes 1939).

Juncus brachycephalus (Engelm.) Buch.

Current status unknown. Collected by the Haneses from a "swampy meadow," a "swamp," and along a "lakeshore" (at least some of these sites are in FEN sedge meadow).

Juncus bufonius L.

Toad Rush

Current status uncertain. Known only from a Hanes collection from the "W shore of Deep Point, Long Lake."

Juncus canadensis La Harpe

Current status uncertain. EM-MARSH.

Juncus dudleyi Wieg. **Hanes:** *J. tenuis* var. *dudleyi*

Current status unknown. Similar to *J. tenuis*, and often lumped with it. Collected by the Haneses from "marshes" in the S½ of the county.

Juncus effusus L.

Current status uncertain. SHRUB-SWAMP and EM-MARSH.

Juncus greenei Oakes & Tuckerman

Current status uncertain. Collected by the Haneses from the S shore of Eagle Lake, from near West Lake, and from the E shore of Austin Lake on "old sand dunes" (open dry and sandy OAK-HARDWOOD-FOREST and oak savanna).

Juncus marginatus Rostk.

Current status unknown. Reportedly "scarce" and "infrequent" on sandy lakeshores.

Juncus nodosus L.

Current status uncertain. SUB-MARSH and EM-MARSH.

Juncus pelocarpus Meyer

Current status unknown. Collected by the Haneses mostly from sandy "swamps" and "lakeshores" in the W½ of the county.

Juncus scirpoides Lam.

Current status uncertain, very rare if still extant. Collected by the Haneses from the E and SW shores of Austin Lake on "old sand dunes." Also collected by L. A. Kenoyer from a "sandy lakeshore" at Pine Island Lake in 1930. The area surrounding Austin Lake has been heavily developed since the last date of collection, and the status of this species at Pine Island Lake is uncertain. At both sites the substrate was sand or peaty sand (Hanes 1939).

Juncus tenuis Willd.

Path Rush

Common. A diversity of relatively open situations.

Juncus torreyi Cov.

Current status uncertain. Once "infrequent" along the sandy shore of Crooked Lake and in a "marsh" at Frank Reid's S of Vicksburg (Hanes & Hanes 1947).

Luzula acuminata Raf.

Wood Rush

Current status uncertain. Collected by the Haneses from an "oak wood on the bank of a small brook at Cooper's Glenn."

Luzula multiflora (Retz.) Lej.

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

LILIACEAE**Lily Family**

A specimen of *Camassia scilloides* (Raf.) Cory (Wild-hyacinth) is in the A. C. Roberts collection (KVM). I have excluded this species from the annotated checklist because the specimen bears no useful collection data and because some of Roberts specimens are of cultivated plants. It should be noted however that most of Roberts specimens were collected from near the Kalamazoo River (including floodplain forest) which is a known habitat for *Camassia scilloides* elsewhere in Michigan.

Aletris farinosa L.

Colic-root; Stargrass

Rare. Once relatively common primarily in the W½ of the county in sandy WET-PRAIRIE and ecotone. Sometimes associated with COASTAL-PLAIN-MARSH (Hanes & Hanes 1947). Now more limited in distribution and less common in the same places due to fire suppression and loss of lakeshore and wetland plant communities. Often associated with other uncommon and unusual plants.

Allium burdickii (Hanes) G. N. Jones **Hanes:** *A. tricoccum* var. *burdickii*

Differs from *A. tricoccum* in having the petioles and sheaths white or green instead of reddish and the leaves lanceolate rather than elliptical in outline. This species also flowers earlier and is smaller than typical *A. tricoccum* with which it is included by some authors (including Voss 1972) as *A. tricoccum* var. *burdickii*. I am not aware of specimens from Kalamazoo County with characters intermediate between the two. The Haneses studied these species in the field, and described *A. burdickii* as a variety of *A. tricoccum* (*A. tricoccum* var. *burdickii* in Hanes & Hanes 1947). Currently *A. burdickii* is occasional in SUGAR-MAPLE-FOREST only in the W tier of townships in Kalamazoo County (Hanes 1953; Hanes & Ownbey 1946; Jones 1979).

Allium canadense L.

Wild Garlic

Occasional. Disturbed ground including RR rights-of-way, roadsides, and old fields.

Allium cernuum Roth

Nodding Wild Onion

Current status uncertain, very rare if still extant. Reported by the Haneses to be "rare" near the S shore of Hampton Lake.

Allium sativum L.

Garlic

Current status uncertain. Roadsides and other waste places. Not native.

Allium tricoccum Aiton

Wild Leek; Ramps

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

Allium vineale L.

Field Garlic

Current status uncertain. Sandy old fields. Not native.

Asparagus officinalis L.

Garden Asparagus

Common. Roadsides and fencerows. Widely established.

Convallaria majalis L.

Lily-of-the-valley

Common. An escape from cultivation, usually in light shade.

Erythronium albidum Nutt.

White Trout Lily

Very rare. Collected by the Haneses from along the Kalamazoo River in section 27 of Comstock Tp. (pointed out by H. R. Becker), and W of Schoolcraft from the "Island woods" (a rich SUGAR-MAPLE-FOREST). Still common in the "Island woods." The Kalamazoo River through section 27 of Charleston Tp. has been extensively altered. It is highly unlikely that this species persists at this site.

Erythronium americanum Ker

Yellow Adder's Tongue

Common. SUGAR-MAPLE-FOREST, FLOODPLAIN-FOREST, and OAK-HARDWOOD-FOREST.

***Hemerocallis fulva* (L.) L.**

Orange Day-lily

Occasional. Roadsides and other disturbed situations. Frequently persists on old homesites and elsewhere where previously cultivated.

***Hemerocallis lilio-asphodelus* L.**

Yellow Day-lily; Lemon-lily

Current status unknown. Not in Hanes & Hanes (1947).

***Lilium michiganense* Farw.**

Michigan Lily

Rare. WET-MEADOW and SHRUB-CARR.

***Lilium philadelphicum* L.**

Wood Lily

Very rare. Collected by the Haneses from along wetland edges with WHITE-OAK-SAVANNA, BUR-OAK-SAVANNA, and BLACK-OAK-BARREN. Also collected from an "oak wood", where it is no longer known. Only two small populations are known to persist, one in disturbed WHITE-OAK-SAVANNA near Sugarloaf Lake, and the other in disturbed BUR-OAK-SAVANNA along the former right-of-way of the MI Central RR just W of the WMU campus.

***Maianthemum canadense* Desf.**

Wild or False Lily-of-the-valley; Canada Mayflower

Common. RED-MAPLE-SWAMP, TAMARACK-SWAMP, ASH-SWAMP, and BOG.

***Medeola virginiana* L.**

Indian Cucumber-root

Occasional. TAMARACK-SWAMP, RED-MAPLE-SWAMP, and SUGAR-MAPLE-FOREST.

***Muscavi botryoides* (L.) Miller**

Current status unknown. Not native.

***Ornithogalum nutans* L.**

Rarely escaped. Often long persistent where planted. Not in Hanes & Hanes (1947).

***Ornithogalum umbellatum* L.**

Star-of-Bethlehem

Current status unknown. A rare and local escape from cultivation. Often long persistent where planted.

Polygonatum biflorum* (Walter) Ell. **Hanes:** *P. commutatum

Smooth Solomon's-seal

Occasional. SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, and on forest edges along roadsides. Sometimes seen beneath solitary pasture oaks and hickories, and in fencerows.

***Polygonatum pubescens* (Willd.) Pursh**

Hairy Solomon's-seal

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Smilacina racemosa* (L.) Desf.**

False Spikenard

Rare. Hilly SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST (Hanes 1945b).

***Smilacina stellata* (L.) Desf.**

Starry False Solomon's-seal

Occasional. A diversity of open and lightly wooded swampy situations including RED-MAPLE-SWAMP and TAMARACK-SWAMP.

***Smilacina trifolia* (L.) Desf.**

Three-leaved Solomon's-seal

Current status uncertain. Collected by the Haneses from a "wooded swamp" S of Vicksburg and from a "boggy swamp" S of Butterfield Lake in section 30 of Ross Tp.

***Smilax ecirrhata* (Kunth) S. Watson**

Carrion-flower

Occasional. A diversity of open and wooded situations including RED-MAPLE-SWAMP, FEN, SUGAR-MAPLE-FOREST, and FLOODPLAIN-FOREST.

***Smilax herbacea* L.**

Carrion-flower

Very rare. Along wooded terrestrial roadsides and in hilly OAK-HARDWOOD-FOREST, mostly in the S½ of the county.

***Smilax illinoensis* Mangaly**

Carrion-flower

Current status uncertain. Collected by the Haneses from along a RR right-of-way through EMERGENT-MARSH in section 20 of Prairie Ronde Tp., from a wetland in section 7 of Wakeshma Tp., and from along the Kalamazoo River E of Galesburg. Included in the Haneses' (1947) *S. herbacea* var. *lasioneura*.

***Smilax lasioneura* Hooker**

Carrion-flower

Occasional. Roadsides and openings in SUGAR-MAPLE-FOREST, HARDWOOD-SWAMP, and RED-MAPLE-SWAMP. Included in the Haneses' (1947) *S. herbacea* var. *lasioneura*.

***Smilax rotundifolia* L.**

Common Greenbriar

Occasional. NW¼ of county growing in OAK-HARDWOOD-FOREST, and BLACK-OAK-BARREN.

Smilax tamnoides* L. Hanes: *S. hispida

Bristly Greenbriar

Current status uncertain. OAK-HARDWOOD-FOREST, especially near wetlands. Not in Hanes & Hanes (1947).

***Tofieldia glutinosa* (Michaux) Pers.**

False Asphodel

Occasional. FEN and probably a former component of WET-PRAIRIE.

***Trillium cernuum* L.**

Nodding Trillium

Rare. RED-MAPLE-SWAMP, ASH-SWAMP, TAMARACK-SWAMP, and FLOODPLAIN-FOREST.

***Trillium erectum* L.**

Stinking Benjamin

Current status uncertain, very rare if still extant. A specimen at KVM labeled "April 1896" may be from Kalamazoo County, but lacks locality data. A specimen originally labeled as *T. flexipes*, was collected by P. W. Thompson in 1964 from "boggy swamp forest" (RED-MAPLE-SWAMP) N of Sugarloaf Lake in section 32 of Portage Tp. (BLH). The petals and ovaries are white, the styles purple, and the filaments are unusually long. This may be an albino form of *T. erectum*, but I am doubtful since the area has been botanized for more than 100 years during which time no other potential specimens of *T. erectum* have been seen. A specimen collected on 22 May 1932 by R. Olmsted from the "bank of the Kalamazoo River in moist woods" may have been collected in Kalamazoo County, but lacks convincing locality data. I know of no unequivocal records, but have included this species here on the authority of Voss (1972). Not in Hanes & Hanes (1947).

***Trillium flexipes* Raf.**

Drooping Trillium

Occasional. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and TAMARACK-SWAMP.

***Trillium grandiflorum* (Michaux) Salisb.**

Common Trillium

Common. SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, FLOODPLAIN-FOREST, and RED-MAPLE-SWAMP.

***Trillium sessile* L.**

Toadshade

Very rare. HARDWOOD-FOREST in the E½ of the county. The larger of the two populations known grows in disturbed HARDWOOD-SWAMP near a channelized stream on clay loam SW of Fulton. The canopy is dominated by *Acer rubrum*, *Carpinus caroliniana*, *Fraxinus americana*, *Populus deltoides*, and *Zanthoxylum americanum*. Associated herbs included *Floerkea proserpinacoides*, *Hydrastis canadensis*, *Isopyrum bitermatum*, *Panax quinquefolius*, and *Podophyllum peltatum*. *Hydrastis canadensis* and *P. quinquefolius* were planted here in the 1950s (K. Chapman, MNFI Site Survey Report 1980).

***Uvularia grandiflora* Sm.**

Bellwort

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Yucca filamentosa* L.**

Yucca; Adam's-needle

Rarely escaped. Dry sandy soil of BLACK-OAK-BARREN, roadsides, and in a prairie planting at the intersection of Oakland Drive and I-94.

***Zigadenus glaucus* (Nutt.) Nutt.**

White Camas

Rare. Overgrown former oak savanna and prairie FEN. Probably once modal in moist oak savanna, prairie, and prairie FEN.

DIOSCOREACEAE**Yam Family*****Dioscorea villosa* L.**

Wild Yam

Occasional. OAK-HARDWOOD-FOREST edges.

AMARYLLIDACEAE**Amaryllis Family*****Hypoxis hirsuta* (L.) Cov.**

Star-grass

Occasional. FEN.

***Narcissus pseudonarcissus* L.**

Daffodil

Occasional. A diversity of open and wooded disturbed situations. May only persist where once planted.

IRIDACEAE**Iris Family*****Belamcanda chinensis* (L.) DC.**

Blackberry-lily

Current status unknown. Once known as an escape from cultivation, but may have only persisted where once planted (Hanes & Hanes 1947). Still widely cultivated.

Iris germanica L.

Flag; Fleur-de-lys

Rarely seen outside of cultivation. May only persist where once planted.

Iris pseudacorus L.

Yellow Flag

First collected by the Haneses in 1947 from a creek S of the Kalamazoo River in the E½ of section 25 of Ross Tp., and from N of the Kalamazoo River along "Sevenmile Creek" in section 24 of Ross Tp. Now occasional in the NE¼ of the county, actively invading wet depressions in FLOODPLAIN-FOREST, shady streamsidess, and other wet areas (Meagher & Tonsor 1992). Not native. Not in Hanes & Hanes (1947).

Iris virginica L.

Southern Blue Flag

Common. Open swampy situations including WET-MEADOW and WET-PRAIRIE.

Sisyrinchium albidum Raf.

White Blue-eyed Grass

Rare. Collected by the Haneses from FEN, WET-PRAIRIE, and TERRESTRIAL-PRAIRIE. No longer known from TERRESTRIAL-PRAIRIE.

Sisyrinchium angustifolium Miller **Hanes:** *S. graminoides*

Stout Blue-eyed Grass

Rare. WET-PRAIRIE and lightly wooded HARDWOOD-SWAMP associated with FEN.

ORCHIDACEAE (Bingham 1939; Case 1987)**Orchid Family**

The orchids of Kalamazoo County have been especially well-studied. The Haneses were fanciers of the Orchidaceae, and the orchids were the subject of my initial fascination with the local flora. For these reasons I have covered the Orchidaceae in rather more detail than other plant families. At least four native orchids are now probably extinct and several others are nearing extinction or may already be gone, but data sufficient to document their absence are lacking. Deer appear to have an important, detrimental effect on at least a few native species. Fire suppression is certainly a factor affecting several others. The richest region in Kalamazoo County for orchids is undoubtedly an approximately one-mile square area in the Gourdneck State Game Area in which at least 27 species of orchids have been collected or observed (not all still extant).

Aplectrum hyemale (Willd.) Torrey

Puttyroot; Adam-and-Eve

Rare. SUGAR-MAPLE-FOREST. More frequent and abundant in relatively open, lightly disturbed forest than in the shade of old, large trees. Curiously absent from many superficially intact former localities.

Arethusa bulbosa L.

Arethusa; Dragon's Mouth

Very rare. *Sphagnum* hummocks near open water in BOG. Four separate populations have been known in Kalamazoo County, two of which are known to be extant. I discovered this species in 1995 in seepage BOG in the Gourdneck State Game Area (Portage Tp.). This is the first report of *A. bulbosa* from the Gourdneck State Game Area. It may be recently adventive at the site, or just previously overlooked (it is very local here and in an exceptionally difficult area to access). Another extant site occurs in a lakeside BOG in Portage Tp. (not reported by the Haneses). Collected by Florence Hanes as early as 1891 at Mud (Veley) Lake, (Alamo Tp.). Last observed here by the Haneses on 4 June 1940 (Hanes 1950). The current status of this site is unknown. Collected on 28 May 1879 and 17 June 1880 by A. C. Roberts "four mi. E of Kalamazoo" (KVM). On one specimen Roberts later wrote "no longer found here".

Calopogon tuberosus* (L.) BSP. Hanes: *C. pulchellus

Grass-pink

Occasional. Wet depressions in BOG and in FEN sedge meadow.

Coeloglossum viride* (L.) Hartman Hanes: *Habenaria viridis* var. *bracteata

Bracted Orchid

Very rare. RED-MAPLE-SWAMP and TAMARACK-SWAMP in the S½ of the county. I observed a solitary plant in bud, growing in TAMARACK-SWAMP near Flowerfield Creek in Prairie Ronde Tp. in 1997. When I returned a week later, I found that the plant had been broken off a few inches above ground level.

***Corallorhiza maculata* Raf.**

Spotted Coral-root

Rare. OAK-HARDWOOD-FOREST.

***Corallorhiza odontorhiza* (Willd.) Nutt.**

Fall Coral-root

Rare. Rich HARDWOOD-SWAMP near FEN and BOG.

***Corallorhiza trifida* Chat.**

Early Coral-root

Extinct. Collected by the Haneses from RED-MAPLE-SWAMP at the S end of Little Sugarloaf Lake. No other sites have ever been known. The forest at this site has since been clear-cut (1995) and local hydrology seriously altered by road construction and other significant disturbances. *Corallorhiza trifida* was last seen here by the Haneses on 15 May 1946.

***Cypripedium acaule* Aiton**

Moccasin Flower; Pink or Stemless Lady-slipper

Occasional. SHRUB-CARR, BOG, FEN, and rarely in young pine plantations and disturbed former oak savanna.

***Cypripedium calceolus* L.**

Yellow Lady-slipper

Occasional. TAMARACK-SWAMP, SHRUB-CARR, RED-MAPLE-SWAMP, seepage BOG, and FEN. Specimens similar to the variety known as *pubescens* (Large Yellow Lady-slipper) are much more common than specimens resembling var. *parviflorum* (Small Yellow Lady-slipper). I do not see a clear distinction between the two vars. in Kalamazoo County. Specimens exhibiting ecological and morphological characters that span the range of those considered characteristic of each variety are known.

Hybrids between the purported var. *pubescens* and *C. candidum* (named *Cypripedium ×andrewsii*) were collected by the Haneses E of Sugarloaf Lake at the "Beaver Dam." This site has since been altered and heavily disturbed, and I have not been able to find any plants here in several years of visits to the area. I recently located a site for this hybrid elsewhere in the Sugarloaf Lakes Region (in the Gourdneck State Game Area) growing in the vicinity of both putative parents. At this site hybrid plants take on almost all intermediate shades imaginable between the colors of their putative parents, including an attractive "buff" color. Most of the plants also appear to be intermediate between their parents in stem and leaf morphology, choice of substrate, and lighting conditions (Case 1993; Klier et al. 1991). This is likely the only extant hybrid population remaining in Kalamazoo County. In my opinion this hybrid population is the result of encroachment of SHRUB-CARR (with associated *C. calceolus*) into prairie FEN meadow (habitat for *C. candidum*) due to fire suppression.

***Cypripedium candidum* Willd.**

White Lady-slipper

Rare in FEN. Declining, and nearly extinct at several sites, primarily due to fire suppression and subsequent shading by shrubs and trees. Known to hybridize with *C. calceolus* (var. *pubescens*) forming the named hybrid, *Cypripedium ×andrewsii* (see *C. calceolus*). This plant has been known from at least nine distinct former sites in Kalamazoo County. It was known to be extant at five of these sites

as of 1996 (three of which are in the Gourdneck State Game Area), but few stems remain at these sites. Clearly, hydrologic changes, fire suppression, and potentially other factors are rapidly taking their toll on this once relatively common orchid.

***Cypripedium reginae* Walter**

Showy Lady-slipper

Rare. TAMARACK-SWAMP, RED-MAPLE-SWAMP, and SHRUB-CARR. I observed a single clump with 53 flowers in Portage Tp. in 1995.

***Epipactis helleborine* (L.) Crantz**

Helleborine

Rare. Disturbed forest. First collected in Kalamazoo County by R. W. Pippen in 1987 near the Kellogg Biological Station and now occasionally encountered throughout the N½ of the county. Most southern location known to date is at the base of a hill on the NE edge of Asylum Lake (observed by the author in September 2002). Locally established and spreading. Not native. Not in Hanes & Hanes (1947).

***Goodyera pubescens* (Willd.) R. Br.**

Downy Rattlesnake Plantain

Rare. Sandy second growth HARDWOOD-SWAMP and RED-MAPLE-SWAMP. Few plants are usually found in a given location. Rarely flowers in Kalamazoo County. Known only from Alamo, Portage, and Schoolcraft Tps. A collection made by the first botanical survey is without locality data.

***Isotria verticillata* (Willd.) Raf.**

Whorled Pogonia

Current status uncertain, very rare if still extant. Collected by the Haneses from *Sphagnum* BOG in the vicinity of the Sugarloaf Lakes. Last observed by C. R. Hanes in the "tamarack swamp" (actually a BOG) "on the E side of Sugarloaf Lake" in 1947 (Figure 2). This site has since been partially flooded and otherwise altered so thoroughly that no significant BOG remains. The plants grew in deep *Sphagnum* moss. Also collected by C. R. Hanes from open *Sphagnum* BOG on the border of tamaracks on the E edge of Mud Lake (Portage Tp.). This site has since been destroyed by residential development and draining. I have been unable to locate plants in dozens of spring and early summer trips to the area over four years (1996–1999). Much formerly open BOG in the Sugarloaf Lakes region has been overgrown by shrubs, *Typha* spp., and Purple Loosestrife, perhaps facilitated by highway construction and other development and exploitation that has seriously altered the hydrology of the region over the last 60 years (C. R. Hanes notes).

***Liparis liliifolia* (L.) Lindley**

Purple Twayblade

Rare. SHRUB-CARR, RED-MAPLE-SWAMP, and a diversity of other shaded situations including under shrubs in dry brushy old fields. Probably not originally native here (although known long ago from other parts of S Lower Michigan). Our plants are likely the result of a recent range change/extension, or at the very least an increase in local population density. First collected in Kalamazoo County in 1993 by P. Olexia (Kalamazoo College) (specimen remains unmounted at WMU). In some places, such as the Arcadia property owned by WMU, *L. liliifolia* is common, and regularly sets fruit. Here, plants grow abundantly in moss beneath *Cornus* and other shrubs in dry soil in old agricultural fields. Capsule development was rare at all sites visited from 1995–2002, but the Arcadia property has consistently been a notable exception (although not visited since 1999). Not only is this the largest single population known in Kalamazoo County (hundreds of plants), but also, most plants develop capsules. I have observed and/or collected specimens from at least ten sites widely scattered throughout the county.

***Liparis loeselii* (L.) Richard**

Loesel's or Green Twayblade; Fen Orchid

Occasional. FEN, BOG, TAMARACK-SWAMP, SHRUB-CARR, and RED-MAPLE-SWAMP, usually on "hummocks" near open water.



FIGURE 2. This photograph of *Isotria verticillata* was taken by the Haneses at Sugarloaf Lake. It appears as Plate 13 in "Orchids of Michigan" (Bingham 1939).

Malaxis monophylla* (L.) Sw. Hanes: *M. brachypoda

White Adder's-mouth

Current status uncertain. Collected by the Haneses from RED-MAPLE-SWAMP/BOG E of Sugarloaf Lake (Portage Tp.) where it grew on decaying wood with mosses. Also known from a "swamp" N of Mud Lake, Pavilion Tp. Both former localities are in the S½ of the county. No extant populations are known with certainty. However, this diminutive plant is easily overlooked, and despite the great number of unsuccessful trips I have made to search for it in the Sugarloaf Lakes region, and the changes that have occurred to the forest and wetlands at this site, it may still be extant. I have only once looked (unsuccessfully) for this plant at Mud Lake (Pavilion Tp.).

***Orchis spectabilis* L.**

Showy Orchis

Rare. Collected by the Haneses from rich SUGAR-MAPLE-FOREST throughout the county. Now absent from many former sites. It is unclear why this species and *Aplectrum hyemale*, both denizens of rich SUGAR-MAPLE-FOREST, have apparently disappeared from much of their former ranges in Kalamazoo County despite the persistence of much superficially suitable habitat. The Haneses make mention in their notes that this species was even then becoming rare. Anecdotal evidence suggests that deer may be involved.

Platanthera ciliaris* (L.) Lindley **Hanes:** *Habenaria ciliaris

Orange Fringed Orchid

Very rare. Collected by the Haneses from BOG and sandy, seasonally moist to wet prairie. Now extirpated from prairie and rare in BOG where only two of at least five former sites currently support plants (one in Portage Tp., and another in Climax Tp.). Human-induced changes in water level and/or heavy shrub growth have apparently destroyed the other former bog sites. At both extant bog sites large numbers of small plants suggest successful reproduction. At a Portage Tp. site a small number (1–2% in 1999) of the flowering plants in any given year have their corms damaged or destroyed by rodents (pers. obs.). Characteristically, these damaged plants have a small (approx. two inch diameter) hole in the *Sphagnum* moss at their bases, and the plants are partially, or wholly toppled, and dead or dying. First collected by John Wright of the first botanical survey on 30 July 1838 in peaty sand (sandy WET-PRAIRIE) at Austin Lake. Collected more than 100 years later by the Haneses at this same site, but the site has since been destroyed by lakeside development. Reacts quite favorably to shrub and tree cutting and removal (observed at both remaining BOG sites).

Platanthera clavellata* (Michaux) Luer **Hanes:** *Habenaria clavellata

Club-spur Orchid

Occasional. RED-MAPLE-SWAMP and adjacent TAMARACK-SWAMP, SHRUB-CARR, and seepage BOG, only near Barton Lake and the Sugarloaf Lakes. The reason for this peculiar distribution is unclear, but may be associated with the distribution of present and former RED-MAPLE-SWAMP (the primary habitat for this species here). Only a small number of the plants present bloom in a given year.

Platanthera dilatata* (Pursh) Lindley ex Beck **Hanes:** *Habenaria dilatata

Tall White Bog Orchid

Rare. FEN sedge meadow. A marly FEN sedge meadow in the Gourdneck State Game Area reported by the Haneses to have more than 130 blooming stems in 1935, had a comparable number of blooming stems in 1996.

The hybrid *P. dilatata* × *P. hyperborea* is known from the Sugarloaf Lakes Region. It usually has greenish flowers with the lip more or less dilated. The Haneses collected specimens on 9 June 1933 from “wooded swamps” at Sugarloaf Lake that were referred to this hybrid by Voss (1972). I have seen a few potential hybrids in open RED-MAPLE-SWAMP and in man-made clearings near the S margin of Little Sugarloaf Lake.

Platanthera flava* (L.) Lindley **Hanes:** *Habenaria flava

Tuberculed Orchid

Very rare. Rich, sandy SHRUB-CARR (former WET-PRAIRIE), and sandy WET-PRAIRIE in the W½ of the county. All specimens are of the var. *herbiola*.

***Platanthera hookeri* (Torrey) Lindley**

Hooker's Orchid

Extinct. Known only from a collection made by A. C. Roberts on 30 May 1879 (KVM). The Haneses were not aware of this collection prior to the publication of their 1947 flora, but report it in Hanes 1950. The only specimen known reads only “Cooper,” but Cooper Tp. is within the area botanized by Roberts, and the specimen is considered by the Haneses to have been collected in Kalamazoo County; therefore, despite the lack of decisive label data, I have tentatively included this species here. Not in Hanes & Hanes (1947).

Platanthera hyperborea (L.) Lindley **Hanes:** *Habenaria hyperborea*

Tall Northern Bog Orchid

Rare. Boggy WET-MEADOW, RED-MAPLE-SWAMP, and TAMARACK-SWAMP.

Platanthera lacera (Michx.) G. Don in Sweet **Hanes:** *Habenaria lacera*

Ragged Fringed Orchid

Rare. Seepage BOG and disturbed ecotone at the interface of forest and wetland. Also known from TERRESTRIAL-PRAIRIE along a RR right-of-way through Prairie Ronde, and from Harris Prairie in Alamo Tp.

Platanthera leucophaea (Nutt.) Lindley **Hanes:** *Habenaria leucophaea*

Prairie Fringed Orchid

Extinct. Collected by the Haneses from hummocks of grass and sedge along the margin of Sugarloaf Lake (F. W. Case Jr. pers. comm.) (also, see Figure 3). Water levels have been altered in the Sugarloaf Lakes region since the plant was last seen, and the Hanes make mention of its decline at this site, perhaps due to hydrological changes (Hanes 1950). A record from 4 mi. E of Kalamazoo dated 4 July 1885 (A. C. Roberts, KVM) reads "only specimen I ever saw". Collected in 1838 from Kalamazoo County by the first botanical survey (NY). May once have occurred W of Sugarloaf Lake in seasonally wet depressions on Prairie Ronde and elsewhere in wet to mesic prairies.

Platanthera orbiculata (Pursh) Lindley **Hanes:** *Habenaria orbiculata*

Round-leaved Orchid

Current status uncertain, very rare if still extant. Collected by the Haneses and by F. W. Rapp from depressions in rich woods (probably SUGAR-MAPLE-FOREST) in several places in the S½ of the county. The Haneses report in their notes in 1934 that they feared they may have collected the last of this species in the county when they dug a specimen in the spring of 1933 and matured it to flowering in their home in a saucer before pressing it for their herbarium. They report the species as "never being very common with us."

Platanthera psycodes (L.) Lindley **Hanes:** *Habenaria psycodes*

Purple Fringed Orchid

Rare. SHRUB-CARR, FEN, WET-MEADOW, and open mucky lakeshores.

Pogonia ophioglossoides (L.) Ker

Rose Pogonia

Occasional. BOG and acid microclimates in FEN.

Spiranthes cernua (L.) Rich.

Nodding Ladies'-tresses

Common. FEN, moist to wet ecotone separating forest and wetland, old fields, and generally just about anywhere with relatively moist soil and in medium to full sun.

Spiranthes lacera (Raf.) Raf.

Slender Ladies'-tresses

Extinct. Reported by C. Hanes (1950) as *S. gracilis* (Bigel.) Beck, based on two specimens collected by A. C. Roberts from oak savanna along the MI Central RR right-of-way 2.5 mi. SW of Kalamazoo, 11 August 1902 (KVM). This is probably the same area where Frank H. Tuthill made a collection in the early 1870s (Hanes 1950; Tuthill 1876). Not in Hanes & Hanes (1947).

Spiranthes lucida (H. H. Eaton) Ames

Shining Ladies'-tresses

Very rare. Known only from a FEN sedge meadow in Charleston Tp. First collected by S. Grund (281 MSC) 7 June 1994. Associated with *Potentilla fruticosa*, *Carex tetanica*, *C. leptalea*, *C. hystrix*, and *Thelypteris palustris*. Not in Hanes & Hanes (1947).

Spiranthes ochroleuca (Rydberg) Rydberg

Very rare. Known only from a collection made by T. Trana 30 September 1993 from "slightly moist



FIGURE 3. This photograph of *Platanthera leucophaea* was taken by the Haneses at Sugarloaf Lake. It appears as Plate 11 in "Orchids of Michigan" (Bingham 1939). Many such sites near the Sugarloaf Lakes are now dominated by *Phragmites*, *Typha*, and *Lythrum salicaria*.

sand" of shady OAK-HARDWOOD-FOREST in the NE¼ of the county (18746 MICH). Associated with *Acer rubrum*, *Asplenium platyneuron*, *Botrychium multifidum*, *Carya* sp., *Quercus velutina*, and *Sassafras albidum*. Not in Hanes & Hanes (1947).

***Spiranthes ovalis* Lindley**

Rare. Collected by R. W. Pippen for the first time in the county and in the state, at the Kellogg Forest, Ross Tp. on 7 October 1966. Also known from WET-MEADOW and OAK-HARDWOOD-FOREST, but only in the NE¼ of the county. Not in Hanes & Hanes (1947).

***Spiranthes romanzoffiana* Cham.**

Hooded Ladies'-tresses

Current status uncertain, very rare if still extant. Not recently collected or observed. Sometimes attributed to Kalamazoo County based on a collection made by J. A. Niewland SE of Bankson Lake (MICH). The actual location of this collection is unclear, but may be in Van Buren County. I have included it here tentatively on the authority of Voss (1972).

***Spiranthes tuberosa* Raf.**

First collected by B. Stergios (MSC), on 9 August 1969 from "Louden old field" in Section 5 Ross Tp. Collected by F. W. Case Jr. on 15 August 1980 from a hillside meadow S of Duck Lake (Ross

Tp.) in mossy, gravelly, sand (possibly the same site as the previous). He found a total of thirteen plants at the site. On 16 August 1980 almost 20 plants were located nearby in an old field. Collected by E. B. Pitcher on 25 August 1992 behind apartments at 1400 N Drake Rd. growing in "clay soil" in an old corn field. Associates were *Aster* spp., *Hieracium* sp., *Polytrichum* sp., and small *Betula papyrifera* saplings. Not in Hanes & Hanes (1947).

***Spiranthes vernalis* Engelm. & Gray**

Current status uncertain, very rare if still extant. Not recently collected or observed. Collected on 2 June 1981 by H. E. Ballard and R. W. Pippen from the SE¼ of section 31 of Texas Tp. Habitat uncertain. No other collections are known. Not in Hanes & Hanes (1947).

***Triphora trianthophora* (Sw.) Rydb.**

Nodding Pogonia; Three Birds Orchid

Extinct. Collected by the Haneses from a single site on a wet-mesic to mesic rise of less than ¼ acre in an otherwise acid and sandy, rich, second-growth HARDWOOD-SWAMP. According to the Haneses' notes the number of stems varied from year to year. Grazing, opening of the canopy by wood cutting, and the death of the single mature American Beech that stood more or less above the plants, may have destroyed this population (pers. obs.). The site is now relatively open and the ground is dominated locally by dense clumps of grasses and sedges. I was unable to find any plants in visits to the former site in 1996, 1997, or 1998. Last collected 8 August 1938 by the Haneses (Hanes 1939).

Dicotyledons

SAURURACEAE

Lizard's-tail Family

***Saururus cernuus* L.**

Lizard's-tail

Rare. FLOODPLAIN-FOREST and rich HARDWOOD-SWAMP in the E½ of the county.

SALICACEAE

Willow Family

Several species are reported here based on annotations made to specimens at WMU by E. G. Voss (Voss 1985).

***Populus alba* L.**

White or Silver Poplar

Rare. Roadsides, lawns, and waste places. Locally established.

***Populus deltoides* Marsh.**

Cottonwood

Common. HARDWOOD-SWAMP, FLOODPLAIN-FOREST, and in a diversity of disturbed situations.

***Populus grandidentata* Michaux**

Large-tooth or Bigtooth Aspen

Common. Upland situations, especially old fields, OAK-HARDWOOD-FOREST, and SUGAR-MAPLE-FOREST.

Occasionally hybridizes with *P. tremuloides* forming the named hybrid *Populus* × *smithii*.

***Populus heterophylla* L.**

Swamp Cottonwood

Very rare. Collected by the Haneses from a swamp forest in Schoolcraft Tp. where it is still locally dominant. This is a male stand, reproducing by root-suckers. Some associates include *Acer rubrum*, *Carex crinita*, *Cephalanthus occidentalis*, *Dioscorea villosa*, *Dryopteris spinulosa*, *Fraxinus pennsylvanica*, *Ilex verticillata*, *Pilea pumila*, *Quercus bicolor*, *Rubus alleghaniensis*, *Vaccinium corymbosum*, and *Vitis riparia* (Wagner et al. 1980).

***Populus nigra* L.**

Lombardy Poplar

Current status unknown. Collected by the Haneses from lakeshores in the W½ of the county. Not native.

***Populus tremuloides* Michaux**

Quaking Aspen

Common. Forming dense thickets in old fields and a diversity of other open and/or disturbed wet to mesic situations including wetlands. Known to hybridize with *P. grandidentata* forming the named hybrid *Populus ×smithii* (see *P. grandidentata*).

***Salix alba* L.**

White Willow

Collected by the Haneses from several wet disturbed situations. Not native, Current status unknown.

The hybrid *Salix ×rubens* (*S. alba* × *S. fragilis*) is known from Kalamazoo County.

***Salix amygdaloides* Andersson**

Peach-leaved Willow

Current status unknown. SHRUB-CARR and associated FEN, usually near water.

***Salix bebbiana* Sarg.**

Beaked or Bebb's Willow

Occasional. SHRUB-SWAMP, FEN, SHRUB-CARR, and WET-MEADOW, especially near the Sugarloaf Lakes, Gourdneck Lake, and Mud Lake (Portage Tp.).

***Salix candida* Willd.**

Sage or Hoary Willow

Occasional. FEN, SHRUB-CARR, and WET-MEADOW.

***Salix discolor* Muhl.**

Pussy Willow

Common. SHRUB-SWAMP, SHRUB-CARR, FEN, and WET-MEADOW.

Salix eriocephala* Michaux **Hanes:** *S. rigida

Current status uncertain. WET-MEADOW, FEN, and SHRUB-CARR.

Salix exigua* Nutt. **Hanes:** *S. interior

Sandbar Willow

Current status uncertain. Margins of lakes, ponds, and streams.

***Salix fragilis* L.**

Crack or Brittle Willow

Rarely escaped. Usually along lakeshores. Known to hybridize with *S. alba* forming the named hybrid *Salix ×rubens* (see *S. alba*).

***Salix humilis* Marsh.**

Upland or Prairie Willow

Occasional. Especially frequent in Oshtemo, Portage, Texas, and Schoolcraft Tps. in sandy former OAK-BARREN.

***Salix lucida* Muhl.**

Shining Willow

Occasional. WET-MEADOW, WET-PRAIRIE, and other wet, open situations, usually with sandy substrates.

Salix myricoides* Muhl. **Hanes:** *S. glaucophylloides

Blue-leaf Willow

Occasional. COASTAL-PLAIN-MARSH on the sandy shores of Pretty, Pine Island, Pleasant, and Eagle Lakes.

Salix nigra Marsh.

Black Willow

Occasional. Depressions in HARDWOOD-SWAMP and FLOODPLAIN-FOREST.

Salix pedicellaris Pursh

Bog Willow

Current status uncertain. BOG.

Salix pentandra L.

Bay-leaved or Laurel Willow

Current status unknown. Collected by the Haneses from a "swamp E of Galesburg." Not native.

Salix petiolaris J. E. Smith **Hanes:** *S. gracilaris* var. *textoris* & *S. subsericia* (possibly a hybrid involving *S. sericea* & *S. petiolaris*)

Slender or Meadow Willow

Current status unknown. WET-MEADOW.

Salix purpurea L.

Basket or Purple-osier Willow

Current status unknown. Collected by the Haneses from lakeshores and other wetland margins. Not native.

Salix sericea Marsh.

Silky Willow

Current status unknown. Collected by the Haneses from "swampy soil" E of Crooked Lake, 2 mi. NW of Fulton, and from section 31 of Oshtemo Tp.

Salix serissima (Bailey) Fern.

Autumn Willow

Current status unknown. Collected by the Haneses from lightly wooded swampy situations including wet openings in TAMARACK-SWAMP and RED-MAPLE-SWAMP.

JUGLANDACEAE

Walnut Family

Carya cordiformis (Wang.) K. Koch

Bitternut Hickory

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST.

Carya glabra (Miller) Sweet **Hanes:** *C. ovalis*

Pignut Hickory

Occasional. OAK-HARDWOOD-FOREST, BLACK-OAK-BARREN, and SUGAR-MAPLE-FOREST.

Carya laciniosa (Michaux f.) G. Don

Kingnut or Shellbark Hickory

Current status uncertain. Collected by the Haneses from HARDWOOD-SWAMP near streams in the E½ of the county. Last observed 1 October 1950 on the border between sections 29 and 32 of Brady Tp., near the Portage River. I searched unsuccessfully for this tree at the aforementioned site in 2002.

Carya ovata (Miller) K. Koch

Shellbark or Shagbark Hickory

Occasional. OAK-HARDWOOD-FOREST and disturbed oak savanna.

Juglans cinerea L.

Butternut

Rare. HARDWOOD-SWAMP, FLOODPLAIN-FOREST, and SUGAR-MAPLE-FOREST, mostly near the Kalamazoo River. Occasionally planted. No longer known from several historic localities, probably due to an introduced fungal pathogen (*Sirococcus clavignenti-juglandacearum*) that causes butternut canker.

***Juglans nigra* L.**

Black Walnut

Occasional. SUGAR-MAPLE-FOREST.

BETULACEAE

Birch Family

***Alnus rugosa* (Duroi) Sprengel**

Speckled Alder

Occasional. Stream margins in SHRUB-CARR, WET-MEADOW, and SHRUB-SWAMP.

Betula alleghaniensis* Britton Hanes: *B. lutea

Yellow Birch

Occasional. TAMARACK-SWAMP and an important component of RED-MAPLE-SWAMP. Rare outside of Portage, Prairie Ronde, and Schoolcraft Tps.

The hybrid *Betula* \times *purpurea* (*B. pumila* \times *B. alleghaniensis*) was collected by the Haneses in section 24 of Texas Twp. (Hanes 1939). The current status of this hybrid is unknown.

***Betula papyrifera* Marsh.**

Paper, White, or Canoe Birch

Locally established. BOG and diverse other wet open disturbed situations. Not in Hanes & Hanes (1947).

***Betula pendula* Roth.**

European White Birch

Locally established. Old fields. Not in Hanes & Hanes (1947).

***Betula pumila* L.**

Bog or Dwarf Birch

Common. BOG, SHRUB-CARR, TAMARACK-SWAMP, and FEN. Known to hybridize with *B. alleghaniensis* forming the named hybrid *Betula* \times *purpurea* (see *B. alleghaniensis*).

***Carpinus caroliniana* Walter**

Hornbeam; Blue-beech

Occasional. Mature, relatively wet SUGAR-MAPLE-FOREST, FLOODPLAIN-FOREST, and occasionally in other kinds of forest, usually near wetlands, and almost always in heavy shade.

***Corylus americana* Walter**

Hazelnut

Occasional. Once a locally important component of oak savanna, TERRESTRIAL-PRAIRIE, and open OAK-HARDWOOD-FOREST, especially near watercourses. The Haneses knew *C. americana* from fencerows, thickets, and streamsides. Today, this species is occasional throughout in remnants of the aforementioned prairie and savanna plant communities, and as occasional individuals along Flowerfield, Arcadia, and other creeks that pass through areas of former prairie and oak savanna.

***Ostrya virginiana* (Miller) K. Koch**

Ironwood; Hop-hornbeam

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

FAGACEAE

Beech Family

Hybrids between members of the genus *Quercus* are frequent and probably involve most of our native species, within their respective subgenera. Relatively few collections have been made of these

hybrids, most are difficult to identify, and few have been identified by experts. Therefore, I have not generally included hybrids in the treatments below.

***Castanea dentata* (Marsh.) Borkh.**

Chestnut

Rare. A small tree was found by T. Robinson, and W. C. Van Deventer growing along a "logging trail" at the edge of a *Sphagnum* bog in the NW¼ of section 15 of Oshtemo Tp. in 1961 (Robinson 1963). They reported that the tree was connected to a below ground root larger than the trunk diameter of the small tree, but they were unable to locate a stump from which the root and hence the sprout could have grown. The tree was transplanted to an unspecified nearby location, and was reported to be "thriving" two years later. There are a few small trees growing in the Lilian Anderson Arboretum in Oshtemo Tp., and a small tree in the vicinity of an old dead tree on the R. Brewer property off 5th street in Oshtemo Tp. The introduced ascomycete fungus *Cryphonectria parasitica* causes Chestnut Blight, a disease that slowly kills the cambium and girdles chestnut trees (Brewer 1995). Not native. Not in Hanes & Hanes (1947).

***Fagus grandifolia* Ehrh.**

Beech

Common. Well-drained SUGAR-MAPLE-FOREST. Beech bark disease has recently been found in Kalamazoo County and may have a significant impact on our remaining SUGAR-MAPLE-FORESTS.

***Quercus alba* L.**

White Oak

Common in a diversity of upland situations. Formerly an important component of oak savanna, especially WHITE-OAK-SAVANNA. Several very large, perhaps original savanna trees, persist, especially in and around the city of Kalamazoo.

***Quercus bicolor* Willd.**

Swamp White Oak

Occasional. RED-MAPLE-SWAMP, HARDWOOD-SWAMP, and FLOODPLAIN-FOREST. Appears to have been a local component of some poorly-drained oak savannas.

***Quercus coccinea* Muench.**

Scarlet Oak

Rare. Dry, sandy, well-drained situations, especially very dry OAK-HARDWOOD-FOREST (sometimes called dry forest) and BLACK-OAK-BARREN. Includes the Haneses' (1947) *Q. ellipsoidalalis*.

***Quercus macrocarpa* Michaux**

Bur Oak

Common. As a relict of oak savanna. Less frequent in SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. Once grew as a "grub" or small tree in BUR-OAK-SAVANNA and less frequently in other kinds of savanna. May have reached the size of an orchard tree in some savannas. Scattered large trees occur in pastures, lawns, and fencerows, and along roadsides where they have persisted (though some are planted) from former BUR-OAK-SAVANNA. Many of the large Bur Oaks scattered about Climax, Kalamazoo, Portage, and Prairie Ronde Tps. (especially in the cities of Kalamazoo and Portage) are relicts of the former BUR-OAK-SAVANNA (sometimes called bur oak plains or oak openings) that occurred in these areas. These large trees are at least 150–200 years old, and may be much older, having grown for an unknown number of years as "grubs" or small trees before fire suppression permitted them to grow into the giants we see today. Even-aged stands of Bur Oak can still be seen in a few places in the county. Here, fire suppression has permitted the former "grubs" and small trees to develop into a forest of Bur Oak. These stands are best seen along U avenue W of US 131 just N of Schoolcraft, on a hillside NE of the intersection of Drake Rd. and West Michigan Ave., in Pioneer Cemetery Park in downtown Kalamazoo, and immediately E of Dry Prairie Cemetery (Portage Tp.) (Brewer & Kitler 1989).

"There is quite an idea that this village site (Kalamazoo) was a grassy plain with scattering burr oaks; but it was a plain covered with thick and tall hazel brush [*Corylus Americana*], so thick that I have seen a wolf jump up so as to see what caused the row he heard; and the burr oaks were very small, little more than grubs. There stands now on West Street [Westnedge Ave.] an oak perhaps two feet through, with a doctor's sign upon it, that when I lived on the spot, several years after I came here, was about the size of a whip stock after I had trimmed it into shape . . ." (Turner 1911).

***Quercus muhlenbergii* Engelm.**

Chinquapin or Yellow Chestnut Oak

Rare. Collected by the Haneses from fencerows, "Island No. 4 in the Kalamazoo River" (Cooper Tp.), Section 30 Charleston Tp., a fencerow W of Cooper's Glen, and "low woods at two separate sites in section 5 of Alamo Tp." Now known only from moist levees dominated by SUGAR-MAPLE-FOREST in a matrix of FLOODPLAIN-FOREST along the Kalamazoo River (once known as "islands" by the Haneses). Status at other previously known sites is uncertain. Occasionally planted.

***Quercus palustris* Muench.**

Pin Oak

Common. Swampy situations including BOG, FEN, TAMARACK-SWAMP, and RED-MAPLE-SWAMP. An important component of acid, sandy HARDWOOD-SWAMP.

***Quercus prinoides* Willd.**

Dwarf Chestnut or Dwarf Chinquapin Oak

Occasional. Collected by the Haneses from Oshtemo, Portage, and Texas Tps. growing in fencerows and "thickets" (sandy former BLACK-OAK-BARREN). Now declining in the same habitats due to increased competition from other shrubs and young trees (due to fire suppression and changes in hydrology) and habitat loss due to development. Once modal in the species rich BLACK-OAK-BARRENS that once dominated large areas of NW Kalamazoo County. At first glance large trees (occasionally exceeding 7m tall and 25 cm diameter at breast height in Oshtemo Tp.) can be confused with *Q. muhlenbergii*.

Quercus rubra* L. Hanes: *Q. borealis

Red Oak

Common. FLOODPLAIN-FOREST, SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST. Large, presumably old trees, are a good indicator of mature terrestrial forest, and can even be found locally in old growth HARDWOOD-SWAMP (of which very little remains in Kalamazoo County).

***Quercus shumardii* Buckley**

Shumard Oak

Current status uncertain, very rare if still extant. Known only from a Hanes collection from the "E side of Austin Lake along the roadway." Residential development has thoroughly altered the remnant savanna and forest mosaic that occurred here when the specimens cited by the Haneses (1947) were collected. R. W. Pippen reports having sought this tree unsuccessfully at the original collection site "many years ago" (R. W. Pippen pers. comm. 1997). I too have looked for this tree unsuccessfully. The specimen at WMU is not wholly typical of this species (see Voss 1985). I have decided to include it here (rather than consider it a hybrid involving some other species) since Shumard Oak has recently been verified as an element of the flora elsewhere in S Michigan (M. Penskar pers. comm. 2004).

***Quercus velutina* Lam.**

Black Oak

Common. All kinds of oak savanna, especially BLACK-OAK-BARREN. Also common in OAK-HARDWOOD-FOREST.

ULMACEAE**Elm Family***Celtis occidentalis* L.

Hackberry

Common. Relatively wet SUGAR-MAPLE-FOREST, FLOODPLAIN-FOREST, and HARD-WOOD-SWAMP. Small trees are often found in fencerows and other marginal habitats, especially near mature (usually planted) trees. Especially frequent in the SW $\frac{1}{4}$ of the county.

Ulmus americana L.

American or White Elm

Common. Swamp and terrestrial forests, and wetlands. Dutch Elm Disease has killed most of the large old trees in the county and has much reduced the importance of American Elm in Kalamazoo County plant communities.

Ulmus pumila L.

Siberian Elm

Common. Expressway rights-of-way, fencerows, and other open waste places. Long cultivated, but only relatively recently naturalized. The weak wood of this fast growing tree readily breaks during ice and snow storms. Locally established and spreading. Not in Hanes & Hanes (1947).

Ulmus rubra Muhl.

Slippery or Red Elm

Occasional. Rich SUGAR-MAPLE-FOREST. The very large trees of this species reported by the Haneses (1947) from the "island" woods are gone. They may have been removed when the forest was last selectively logged and reduced in size in the 1960s, or they may have succumbed to Dutch Elm Disease.

Ulmus thomasii Sarg.

Rock or Cork Elm

Rare. HARDWOOD-SWAMP, FLOODPLAIN-FOREST, and SUGAR-MAPLE-FOREST, mostly in the E $\frac{1}{2}$ of the county, and especially near the Kalamazoo River.

MORACEAE**Mulberry Family***Maclura pomifera* (Raf.) Schneider

Osage-orange

Occasional. An escape from cultivation in dry old fields, fencerows, BLACK-OAK-BARREN, and degraded OAK-HARDWOOD-FOREST. Locally established.

Morus alba L.

Russian or White Mulberry

Common. Open disturbed habitats, especially fencerows and hedges. Widely established.

Morus rubra L.

Red Mulberry

Current status uncertain. Not recently collected or observed. Collected by the Haneses from swamp forest and fencerows in Charleston and Wakeshma Tps. Also reported by the Haneses (1947) based on a personal communication with H. R. Becker (and without a specimen) from Camp Custer.

CANNABACEAE Hanes: Included in MORACEAE**Hemp Family***Cannabis sativa* L.

Hemp; Marijuana

Rarely escaped. Waste places.

Humulus lupulus L. Hanes: *H. americanus*

Common Hops; Hop

Occasional. Fencerows and roadsides. At least partly introduced.

URTICACEAE**Nettle Family**

Boehmeria cylindrica (L.) Sw.

False Nettle

Occasional. TAMARACK-SWAMP, HARDWOOD-SWAMP, RED-MAPLE-SWAMP, FLOOD-PLAIN-FOREST, and SUGAR-MAPLE-FOREST.

Laportea canadensis (L.) Wedd.

Wood Nettle

Common. SUGAR-MAPLE-FOREST and HARDWOOD-SWAMP.

Parietaria pensylvanica Willd.

Pellitory

Current status unknown. RED-MAPLE-SWAMP and relatively wet SUGAR-MAPLE-FOREST.

Pilea fontana (Lunell) Rydberg

Lesser Clearweed

Occasional. A diversity of wooded wetlands.

Pilea pumila (L.) A. Gray

Clearweed

Common. HARDWOOD-SWAMP, FLOODPLAIN-FOREST, and SUGAR-MAPLE-FOREST.

Urtica dioica L.

Stinging Nettle

Common. Disturbed TAMARACK-SWAMP and WET-MEADOW. Mostly native, but introduced plants probably also occur here.

SANTALACEAE**Sandalwood Family**

Comandra umbellata (L.) Nutt. **Hanes:** *C. richardsiana*

Bastard-toadflax; Star-toadflax

Occasional. Mostly in the W½ of the county, in oak savanna and TERRESTRIAL-PRAIRIE.

ARISTOLOCHIACEAE**Birthwort Family**

Asarum canadense L.

Wild-ginger

Common. FLOODPLAIN-FOREST and ASH-SWAMP. Occasionally in other kinds of forest. Includes the Haneses (1947) *A. reflexum*.

POLYGONACEAE**Smartweed Family**

Several species are reported here based on herbarium specimens at WMU annotated by E. G. Voss and mapped in Volume II. of Michigan Flora (1985).

Fagopyrum esculentum Moench

Buckwheat

Current status unknown. Reported by the Haneses as an occasional, but not long persistent escape from cultivation in fields, along roadsides and RR rights-of-way, and near (grain) "elevators."

Polygonella articulata (L.) Meissner

Jointweed

I found the first plants of this species in 1996 growing in full sun in a very dry and sandy BLACK-OAK-BARREN reconstruction SE of the intersection of Centre St. and US 131. It is now relatively common (2002) in disturbed open situations in dry sand in the W two tiers of sections in Oshtemo and Alamo Tps. (R. Brewer pers. comm. 2003). Probably adventive. Not in Hanes & Hanes (1947). Locally established and spreading.

***Polygonum achoreum* Blake**

Current status unknown. First recorded in 1930 from "barnyards" in and near Schoolcraft. Not native.

***Polygonum amphibium* L**

Water Smartweed

Common. EM-MARSH, SHRUB-SWAMP, and other wetlands, including wet, disturbed situations in lawns, old fields, and ditches. This species is at least partly introduced in Kalamazoo County. The Haneses' *Polygonum coccineum* (now more commonly known as *P. amphibium* var. *emersum*), is found throughout the county.

***Polygonum arifolium* L.**

Tear-thumb

Occasional. SHRUB-SWAMP, EM-MARSH, WET-MEADOW, and along the margins of lakes and streams.

***Polygonum aviculare* L.**

Knotweed

Current status uncertain. Lawns and roadsides. Not native.

***Polygonum convolvulus* L.**

Black-bindweed; False Buckwheat

Current status uncertain. Open disturbed ground and waste places. Not native.

***Polygonum cuspidatum* Sieb. & Zucc.**

Japanese Knotweed; "Mexican Bamboo"

Current status uncertain. Fencerows, roadside ditches, and wet waste places. Not native.

***Polygonum erectum* L.**

Erect Knotweed

Current status unknown. Collected by the Haneses from a roadside and farmyard, both in the E½ of the county.

***Polygonum hydropiper* L.**

Water-pepper

Common. Lawns and old fields. Not native.

***Polygonum hydropiperoides* Michaux**

Mild Water-pepper

Current status unknown. Collected by the Haneses from "wet ground" S of the shoreline of Eagle Lake and from the NW½ of Cooper Tp.

***Polygonum lapathifolium* L.**

Willow-weed; Nodding Smartweed

Current status uncertain. WET-MEADOW, EM-MARSH, and FEN. Partly introduced.

***Polygonum orientale* L.**

Prince's Feather; Kiss-me-over-the-garden-gate

Locally established. Waste places throughout.

***Polygonum pensylvanicum* L.**

Pinkweed; Bigseed Smartweed

Common. EM-MARSH and wet depressions in FEN and WET-MEADOW, often near streams.

***Polygonum persicaria* L.**

Heart's-ease; Lady's-thumb

Current status uncertain. Cultivated ground and roadsides. Not native.

***Polygonum punctatum* Ell.**

Dotted Smartweed

Current status uncertain. SHRUB-SWAMP, WET-MEADOW, and FEN, mostly in the S½ of the county.

***Polygonum sagittatum* L.**

Tear-thumb

Common. SHRUB-SWAMP, WET-MEADOW, and EM-MARSH.

***Polygonum scandens* L.**

False Buckwheat; Black-bindweed

Current status uncertain. Swamp forests, especially at edges.

***Polygonum tenue* Michaux**

Slender Knotweed

Current status unknown. Collected by the Haneses from BLACK-OAK-BARREN mostly in the west half of the county.

Polygonum virginianum* L. Hanes: *Tovara virginiana

Jumpseed

Occasional. HARDWOOD-SWAMP, FLOODPLAIN-FOREST, and SUGAR-MAPLE-FOREST.

***Rumex acetosella* L.**

Sheep or Red Sorrel

Common. A diversity of dry and open, disturbed situations. Widely established.

***Rumex altissimus* Wood**

Pale Dock

Current status unknown. Collected by the Haneses from a roadside "½ mi. W of Schoolcraft," and from a roadside on the S side of section 16 of Brady Tp. "in somewhat moist soil." No other collections are known.

***Rumex crispus* L.**

Curly or Sour Dock

Common. A diversity of wet open habitats including roadside ditches, EM-MARSH, and boggy WET-MEADOW. Not native.

***Rumex obtusifolius* L.**

Bitter Dock

Current status uncertain. Ditches, EM-MARSH, WET-MEADOW, and lawns. Not native.

***Rumex orbiculatus* A. Gray**

Great Water Dock

Occasional. EM-MARSH including ponds, ditches, and lakeshores.

***Rumex triangulivalvis* (Danser) Rech. f.**

Current status unknown. Collected by the Haneses on 23 June 1953 from along a RR right-of-way ¼ mi. W of the "Knappen elevator" near Schoolcraft. Not in Hanes & Hanes (1947).

***Rumex verticillatus* L.**

Water Dock

Current status uncertain. FLOODPLAIN-FOREST.

CHENOPODIACEAE**Goosefoot Family**

A young specimen lacking fruit and with the leaves three-nerved at the base was collected 14 July 1926 by L. A. Kenoyer near the "New Borgess Hospital in dry soil" (WMU). Voss (1985) says this specimen may represent *Chenopodium dessicatum* A. Nelson, Narrow-Leaved Goosefoot (the Hane-

ses' (1947) *C. pratericola*). Since this specimen is difficult to place, I have chosen not to treat it separately below.

***Atriplex patula* L.**

Spearscale

Occasional. Open disturbed situations. Not native.

***Chenopodium album* L.**

Lamb's-quarters; "Pigweed"

Common. Gardens, cultivated fields, and recently cleared ground. Widely established. Includes the Haneses' (1947) *C. berlandieri*.

***Chenopodium ambrosioides* L.**

Wormseed; Mexican-tea

Collected by the first botanical survey in 1838 (Voss 1985). Not since collected or observed. Not native.

***Chenopodium botrys* L.**

Jerusalem-oak

Current status unknown. Collected by the Haneses from the S½ of the county. Also collected by the first botanical survey. Not native.

Chenopodium hybridum* L. Hanes: *C. gigantospermum

Maple-leaved Goosefoot

Current status unknown. Gardens and other open disturbed ground.

***Chenopodium murale* L.**

Nettle-leaved Goosefoot

Current status unknown. First collected in 1935 from the Haneses' garden in Schoolcraft. Not native.

***Cycloloma atriplicifolium* (Sprengel) Coulter**

Winged Pigweed

Current status uncertain. Dry, sandy, disturbed situations, especially along RR rights-of-way. Not native.

***Kochia scoparia* (L.) Schrader**

Summer-cypress

Current status unknown. Collected by the Haneses near a dump in Schoolcraft. Not native.

Salsola kali* L. Hanes: *S. pestifer

Russian-thistle

Occasional. RR rights-of-way, dry sandy roadsides, and dry disturbed ground. Widely established.

AMARANTHACEAE

Amaranth Family

***Amaranthus albus* L.**

Tumbleweed

Occasional. Dry sandy soil, especially roadsides and RR rights-of-way. Widely established.

Amaranthus blitoides* S. Watson Hanes: *A. graecizans

Prostrate Amaranth

Occasional. Cultivated fields, roadsides, and gardens. Not native.

***Amaranthus cruentus* L.**

Purple Amaranth

Current status unknown. Collected by the Haneses from near the Schoolcraft Town Dump, and from along a roadside 1 mi. S of Crooked Lake. Not native.

***Amaranthus hybridus* L.**

Green Amaranth

Common. Cultivated fields, gardens, and pastures. Widely established.

***Amaranthus hypochondriacus* L.**

Locally established. Not in Hanes & Hanes (1947). Not native.

***Amaranthus powellii* S. Watson**

Current status unknown. Collected by the Haneses from disturbed ground. Not in Hanes & Hanes (1947). Not native.

***Amaranthus retroflexus* L.**

Green Amaranth

Occasional. A weed of agricultural crops and pastures throughout the county. Probably native. The first Michigan collection was made by the first survey in 1838 at Grand Prairie.

Amaranthus tuberculatus* (Moq.) Sauer Hanes: *Acnida altissima

Tall Water Hemp

Current status uncertain. EM-MARSH.

NYCTAGINACEAE**Four-o'clock Family*****Mirabilis hirsuta* (Pursh) MacM. Hanes: *Oxybaphus hirsutus***

Hairy Umbrellawort

Current status unknown. Collected by the Haneses from along RR rights-of-way E and W of Schoolcraft. Not native.

Mirabilis nyctaginea* (Michaux) MacM. Hanes: *Oxybaphus nyctagineus

Wild Four-o'clock

Occasional. RR rights-of-way and roadsides. Widely established.

PHYTOLACCACEAE**Pokeweed Family*****Phytolacca americana* L.**

Pokeweed; Poke

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST, often in tree-fall gaps. Also in fencerows and other disturbed situations.

MOLLUGINACEAE Hanes: AIZOACEAE**Carpetweed Family*****Mollugo verticillata* L.**

Carpetweed

Common. Disturbed ground. Probably native.

PORTULACACEAE**Purslane Family*****Claytonia virginica* L.**

Spring Beauty

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. The Haneses report this species from "prairie roadsides" on Prairie Ronde.

***Portulaca grandiflora* Hooker**

Rose-moss

Locally established. Lawns.

***Portulaca oleracea* L.**

Purslane; Pusley

Common. Gardens, sidewalk cracks, and parking lots. Widely established.

CARYOPHYLLACEAE**Pink Family***Agrostemma githago* L.

Corn-cockle

Not recently collected or observed. A former weed in rye and other grain fields. Not native.

Arenaria serpyllifolia L.

Thyme-leaved Sandwort

Common. RR rights-of-way, sandy roadsides, and BLACK-OAK-BARREN, mostly in the W½ of the county. Not native.

Arenaria stricta Michaux

Rock Sandwort

Current status uncertain, very rare if still extant. Collected by the Haneses from sandy BLACK-OAK-BARREN and hillside prairie, and by the first botanical survey from Grand Prairie. Richard Brewer (1984) reports this species from the former right-of-way of the MI Central RR on the N edge of Genesee Prairie. This site has been partly destroyed by development.

Cerastium arvense L.

Field Chickweed

Current status unknown. Probably native in BLACK-OAK-BARREN and other dry, usually sandy, open areas including lawns and roadsides. Not in Hanes & Hanes (1947).

Cerastium fontanum Baumg. **Hanes:** *C. vulgatum*

Mouse-ear Chickweed

Common in a diversity of disturbed open situations. Not native.

Cerastium nutans Raf.

Nodding Chickweed

Current status unknown. Collected by the Haneses from "the border of woods and in an old field in section 4 of Prairie Ronde Tp."

Cerastium semidecandrum L.

Current status uncertain. Sandy open ground along roadsides and in lawns and parks. Not native. Not in Hanes & Hanes (1947).

Cerastium tomentosum L.

Snow-in-summer

Locally established. Lawns and roadsides. Not native. Not in Hanes & Hanes (1947).

Dianthus armeria L.

Deptford Pink

Occasional. Dry roadsides, RR rights-of-way, and old fields.

Dianthus barbatus L.

Sweet William

Locally established. Cemeteries.

Dianthus deltoides L.

Maiden Pink

Locally established. Cemeteries.

Lychnis coronaria (L.) Desr.

Mullein Pink

Occasional. Roadsides, lightly wooded hillsides, and other dry, lightly shaded situations.

Myosoton aquaticum (L.) Moench **Hanes:** *Stellaria aquatica*

Giant Chickweed

Current status unknown. Collected by the Haneses only from "the border of a swamp" S of Mud Lake in Brady Tp. Not native.

***Paronychia canadensis* (L.) Wood**

Forked Chickweed

Current status uncertain. Sandy OAK-HICKORY-FOREST and oak savanna. Also known from relatively wet prairie-like situations.

***Saponaria officinalis* L.**

Bouncing Bet; Soapwort

Common. Roadsides, RR rights-of-way, and other moist, more or less disturbed situations. Double-flowered plants are frequently encountered. Widely established.

***Scleranthus annuus* L.**

Current status unknown. First collected in 1934 by the Haneses from a cultivated field in Section 16 Prairie Ronde Tp. Not native.

***Silene antirrhina* L.**

Sleepy Catchfly

Occasional. Open roadsides, RR rights-of-way, fencerows, and BLACK-OAK-BARREN.

***Silene armeria* L.**

Sweet-William Catchfly

Occasional. Roadsides, RR rights-of-way, old fields, and other dry, disturbed situations. Widely established.

***Silene dichotoma* Ehrh.**

Common. BLACK-OAK-BARREN, OAK-HARDWOOD-FOREST, and other sandy disturbed situations.

***Silene noctiflora* L.**

Night-flowering Catchfly

Occasional. Old fields, roadsides, and RR rights-of-way.

Silene pratensis* (Rafn) Goron & Gren. **Hanes:** *Lychnis alba

White Cockle; White Campion

Common. Disturbed, open situations. Not native.

***Silene stellata* (L.) Aiton f.**

Starry Campion

Very rare. According to the Haneses (1947) this species was "rare" on "wooded banks" (probably overgrown WHITE-OAK-SAVANNA, and in my opinion, not typical hillside prairie), mostly near the Kalamazoo River (Hanes & Hanes 1947). Collected in 1975 by R. W. Pippen from an opening in an even-aged Black Oak and White Oak forest (former WHITE-OAK-SAVANNA) W of the "Goldsworth Valley" Dormitories at WMU. The only known extant occurrence is a small patch of seven plants (August 2002) on the N side of Asylum Lake on a steep slope beneath large Black and White Oaks in loamy sand, and associated with *Antennaria parlinii*, *Aster macrophyllus*, *Poa compressa*, *Carex pensylvanica*, *Prunus serotina*, and *Pteridium aquilinum*. Few other prairie plants persist in the heavy shade at this site. This area is within the former right-of-way of the MI Central RR, and is a nice overgrown hillside in apparently uncultivated former WHITE-OAK-SAVANNA. This is also a former site for *Silphium integrifolium*. *Silene stellata* may once have been frequent in hilly WHITE-OAK-SAVANNA throughout Kalamazoo County.

Silene vulgaris* (Moench) Garcke **Hanes:** *S. cucubalus

Bladder Campion

Occasional. Roadsides, RR rights-of-way, and in other dry, disturbed situations. Not native.

Stellaria crassifolia Ehrh.

Rare. Most collections are from the interface between FEN and open water, especially along the edges of streams.

Stellaria graminea L.

Lesser Stitchwort

Current status uncertain. RR rights-of-way in and around Schoolcraft and Vicksburg. Not native.

Stellaria longifolia Willd.

Long-leaved Stitchwort

Current status uncertain. TAMARACK-SWAMP, RED-MAPLE-SWAMP, and wooded FEN and BOG.

Stellaria media (L.) Vill.

Common Chickweed

Common in a diversity of relatively open situations.

Vaccaria hispanica (Miller) Rauschert

Cow Herb

Current status unknown. Collected by H. R. Becker from a lawn in Charleston Tp. on 20 July 1951. Not native. Not in Hanes & Hanes (1947).

CERATOPHYLLACEAE**Hornwort Family***Ceratophyllum demersum* L.

Hornwort

Occasional. SUB-MARSH and EM-MARSH.

NYMPHAEACEAE**Water-lily Family***Brasenia schreberi* J. F. Gmelin

Water-shield

Common. Usually in SUB-MARSH and EM-MARSH of sandy-bottomed lakes.

Cabomba caroliniana A. Gray

Fanwort

First collected by F. W. Rapp in 1935, but cited as 1936 in the Haneses' flora (Hanes 1938; Hanes & Hanes 1947). Collected by the Haneses from Kimble, Barton, Howard, and other lakes connected to Portage Creek. Still extant (fall 2002), and covering large areas of the aforementioned lakes and waterways to the exclusion of most native aquatic vegetation. Appears to contribute substantially to the accumulation of organic material on the lake bottom. Probably not native.

Nelumbo lutea (Willd.) Pers. **Hanes:** *N. pentapetala*

American Lotus; "Lotus-lily"

Extinct. Occurred in EM-MARSH at Sunset Lake in Vicksburg (a former Mill Pond), probably since the middle of the 19th century (Voss 1972). To my knowledge, first collected by W. J. Beal in 1878 and last collected by the Haneses on 11 July 1934. A short, typed report on the flora of the county written by C. R. Hanes (date of preparation unknown, but certainly post 1934), reads "The Lotus, which formerly grew at Vicksburg . . .". This suggests that it was by then extinct. Not collected or reported since the 1934 Hanes collection. Probably not native.

Nuphar advena (Aiton) Aiton f.

Yellow Spatterdock

Common. SUB-MARSH and EM-MARSH of lakes, ponds, and streams.

Nuphar variegata Durand **Hanes:** *N. variegatum*

Variegated Spatterdock

Occasional. SUB-MARSH and EM-MARSH of ponds and lakes, usually in open water.

***Nymphaea odorata* Aiton**

Sweet Water Lily

Common. SUB-MARSH and EM-MARSH. Here includes *N. tuberosa*, (see Voss 1972). Includes the Haneses' (1947) *N. tuberosa*.**RANUNCULACEAE****Buttercup Family*****Actaea pachypoda* Ell.**

White Baneberry; Doll's-eyes

Occasional. SUGAR-MAPLE-FOREST.

***Actaea rubra* (Aiton) Willd.**

Red Baneberry

Rare. HARDWOOD-SWAMP and relatively wet SUGAR-MAPLE-FOREST.

***Anemone canadensis* L.**

Canada Anemone

Rare. Collected by the Haneses from WET-PRAIRIE, WET-MEADOW, and from roadsides and RR rights-of-way. No longer known from WET-PRAIRIE.

***Anemone cylindrica* A. Gray**

Thimbleweed

Occasional. RR rights-of-way and sandy BLACK-OAK-BARREN.

***Anemone quinquefolia* L.**

Wood Anemone

Occasional. WET-MEADOW, RED-MAPLE-SWAMP, TAMARACK-SWAMP, and FEN.

***Anemone virginiana* L.**

Thimbleweed

Occasional. OAK-HARDWOOD-FOREST, especially forest edges. Probably once also occurred in oak savanna.

***Anemonella thalictroides* (L.) Spach**

Rue-anemone

Common. SUGAR-MAPLE-FOREST.

***Aquilegia canadensis* L.**

Wild Columbine

Occasional. FEN and WET-PRAIRIE.

***Caltha palustris* L.**

Marsh Marigold; Cowslip

Common. FEN, WET-MEADOW, and HARDWOOD-SWAMP.

***Clematis virginiana* L.**

Virgin's-bower

Occasional. BUR-OAK-SAVANNA, WET-MEADOW, FEN, WET-PRAIRIE, and RR rights-of-way.

Consolida ambigua* (L.) Ball & Heywood Hanes: *Delphinium ajacis

Larkspur

Collected by the Haneses from a roadside near woods S of Austin Lake on 16 July 1935. Not since collected. Not native.

Coptis trifolia* (L.) Salish. Hanes: *C. groenlandica

Goldthread

Common. RED-MAPLE-SWAMP and TAMARACK-SWAMP.

***Hepatica acutiloba* DC.**

Sharp-lobed Hepatica

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Hepatica americana* (DC.) Ker**

Round-Leaved Hepatica

Occasional. Well-drained SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. Reported by R. Brewer (1984) from TERRESTRIAL-PRAIRIE along the former right-of-way of the MI Central RR on the edge of Genesee Prairie.

***Hydrastis canadensis* L.**

Goldenseal

Rare. Rich HARDWOOD-SWAMP and SUGAR-MAPLE-FOREST. Sometimes associated with other relative rarities such as *Panax quinquefolius*. Planted in HARDWOOD-SWAMP SW of Fulton in the 1950s (K. Chapman, MNFI Site survey 1980).***Isopyrum biternatum* (Raf.) T. & G.**

False Rue-anemone

Occasional. FLOODPLAIN-FOREST, SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST. Less frequent than *Anemonella thalictroides* with which it is often confused.***Ranunculus abortivus* L.**

Small-flowered Buttercup

Common. RED-MAPLE-SWAMP, FLOODPLAIN-FOREST, SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, roadsides, and old fields.

***Ranunculus acris* L.**

Tall or Common Buttercup

Occasional. RR rights-of-way, roadsides, and other disturbed situations. Not native.

***Ranunculus fascicularis* Bigelow**

Early Buttercup

Rare. TERRESTRIAL-PRAIRIE and open OAK-HARDWOOD-FOREST. Easily overlooked because it flowers in late March and April (as in the Pioneer cemetery on 12th street near Schoolcraft). Once also a component of dry-mesic to mesic oak savannas.***Ranunculus flabellaris* Raf.**

Yellow Water Crowfoot

Current status unknown. Collected by the Haneses from EM-MARSH. Most specimens were collected in water at pond edges or in SHRUB-SWAMP.

***Ranunculus hispidus* Michaux**

Swamp Buttercup

Both var. *hispidus* and var. *caricetorum* occur in Kalamazoo County (Voss 1985). The var. *caricetorum* is occasional in FEN and shrubby WET-MEADOW, usually near open water. Typical var. *hispidus* is relatively rare? throughout in dry, usually sandy situations in OAK-HARDWOOD-FOREST. Includes the Haneses' (1947) *R. septentrionalis*.***Ranunculus longirostris* Godron**

White Water Crowfoot

Current status uncertain. EM-MARSH of creeks, lakes, drainage ditches, and ponds. Includes the Haneses (1947) *R. trichophyllus*.***Ranunculus pensylvanicus* L. f.**

Bristly Crowfoot

Occasional. WET-MEADOW and EM-MARSH.

***Ranunculus recurvatus* Poiret**

Hooked Crowfoot

Occasional. HARDWOOD-SWAMP.

***Ranunculus repens* L.**

Creeping Buttercup

Current status uncertain. RR rights-of-way and roadsides, especially near wetlands.

***Ranunculus sceleratus* L.**

Cursed Crowfoot

Occasional. EM-MARSH, WET-MEADOW, and FEN. Probably at least in part introduced.

***Thalictrum dasycarpum* Fisch. & Avé-Lall.**

Purple Meadow-rue

Occasional. WET-MEADOW, WET-PRAIRIE, and FEN.

***Thalictrum dioicum* L.**

Early Meadow-rue

Occasional. Open OAK-HARDWOOD-FOREST, often on hillsides.

BERBERIDACEAE**Barberry Family*****Berberis thunbergii* DC.**

Japanese Barberry

Rarely escaped. Disturbed SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Berberis vulgaris* L.**

Common Barberry

Last collected by the Haneses from section 23 of Portage Tp. in 1945. Only two bushes were ever known outside of cultivation. No recent collections or reports are known.

***Caulophyllum thalictroides* (L.) Michaux**

Blue Cohosh

Occasional. Rich SUGAR-MAPLE-FOREST.

Mahonia aquifolium* (Pursh) Nutt. Hanes: *Berberis aquifolium

Oregon-grape

Locally established. OAK-HARDWOOD-FOREST in the S½ of the county.

***Podophyllum peltatum* L.**

May-apple; Mandrake

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

MENISPERMACEAE**Moonseed Family*****Menispermum canadense* L.**

Moonseed

Reportedly found in FLOODPLAIN-FOREST along the Kalamazoo River at the Augusta Floodplain Forest Preserve (Meagher & Tonsor 1992). Not native. Not in Hanes & Hanes (1947).

MAGNOLIACEAE**Magnolia Family*****Liriodendron tulipifera* L.**

Tulip-tree; Tulip-poplar; Yellow-poplar

Occasional. SUGAR-MAPLE-FOREST. A massive old tree more than 1 m in diameter at chest height grows in old SUGAR-MAPLE-FOREST near Paw Paw Lake.

ANNONACEAE**Custard-apple Family**

Asimina triloba (L.) Dunal

Pawpaw

Occasional. Mostly in the S½ of the county in wet depressions in rich, relatively wet SUGAR-MAPLE-FOREST, ASH-SWAMP, and HARDWOOD-SWAMP.

LAURACEAE**Laurel Family**

Lindera benzoin (L.) Blume

Spicebush

Common. ASH-SWAMP, TAMARACK-SWAMP, HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and FLOODPLAIN-FOREST.

Sassafras albidum (Nutt.) Nees

Sassafras

Common. Open to lightly wooded situations. Often particularly abundant in overgrown WHITE-OAK-SAVANNA and at OAK-HARDWOOD-FOREST edges.

PAPAVERACEAE**Poppy Family**

Chelidonium majus L.

Celandine

Occasional. SUGAR-MAPLE-FOREST and FLOODPLAIN-FOREST. Not native.

Macleaya cordata (Willd.) R. Br.

Plume Poppy

Current status unknown. Reported by Voss (1985). Not in Hanes & Hanes (1947). Not native.

Papaver orientale L.

Oriental Poppy

Current status unknown. Collected by W. T. Gillis from the NE¼ S5 Ross Tp. (14692 MSC) on 12 June 1978, "relict from cultivation, spreading onto roadsides." Not in Hanes & Hanes (1947). Not native.

Papaver rhoeas L.

Corn, Field, or Flanders Poppy

Current status unknown. Collected by the Haneses from the "Crissel yard" in the village of Schoolcraft on 10 August 1937. Specimen label also reads "roadsides & gardens." Not in Hanes & Hanes (1947). Not native.

Sanguinaria canadensis L.

Bloodroot

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. Interestingly, the Haneses report finding only a few plants along the roadside W of Schoolcraft alongside the "Island" woods where they note that it was once abundant. Today, *S. canadensis* is again abundant throughout the remaining few acres of the "Island" woods.

Stylophorum diphyllum (Michaux) Nutt.

Celandine or Wood Poppy

Occasional. Rich SUGAR-MAPLE-FOREST.

FUMARIACEAE**Fumitory Family**

Adlumia fungosa (Aiton) BSP.

Climbing Fumitory; Alleghany Vine

Extinct. Collected by A. C. Roberts "SW of Kalamazoo, near Winslow's" (KVM). There is no date or habitat given on this specimen. Not in Hanes & Hanes (1947). Possibly adventive.

***Corydalis flavula* (Raf.) DC.**

Yellow Harlequin

Rare. Comstock Tp. near the Kalamazoo River in moist to wet soil, including along trails in disturbed forest (Higman 1997). Possibly introduced.

***Dicentra canadensis* (Goldie) Walp.**

Squirrel-corn

Occasional. SUGAR-MAPLE-FOREST.

***Dicentra cucullaria* (L.) Bernh.**

Dutchman's-breeches

Common. SUGAR-MAPLE-FOREST.

CAPPARACEAE Hanes: CAPPARACEAE**Caper Family**

Cleome serrulata Pursh, (Rocky Mountain Bee Plant) is reported from the Augusta Floodplain Forest Preserve growing in a "weed-patch" on a moist rise of soil (Meagher & Tonsor 1992). I have not been able to locate a specimen at KBSMS, MICH, MSC, or WMU, and have not formally included it below in the annotated checklist. Not native. Not in Hanes & Hanes (1947).

Polanisia dodecandra* (L.) DC. Hanes: *Polanesia graveolens

Clammy-weed

Current status unknown. Known only from ballast along a RR right-of-way near the N boundary of Section 5 Schoolcraft Tp.

CRUCIFERAE (BRASSICACEAE)**Mustard Family*****Alliaria petiolata* (Bieb.) Cavara & Grande**

Garlic Mustard

Common. Swamp and terrestrial forests, and lightly shaded disturbed situations throughout. An aggressive threat to the diversity of our native woodland flora. Widely established.

***Alyssum alyssoides* (L.) L.**

Pale Alyssum

Occasional. RR rights-of-way and roadsides. Locally established.

***Arabidopsis thaliana* (L.) Heynh.**

Mouse-ear Cress

Occasional. RR rights-of-way, roadsides, lawns, old fields, and disturbed ground. Not native.

***Arabis canadensis* L.**

Sickle-pod

Current status uncertain. OAK-HARDWOOD-FOREST and BLACK-OAK-BARREN, usually on steep slopes including hillside prairie.

***Arabis glabra* (L.) Bernh.**

Tower Mustard

Occasional. Moist sandy lakeshores and similar sunny, moist situations, primarily in the W½ of the county.

***Arabis hirsuta* (L.) Scop.**

Hairy Rock Cress

Current status uncertain. OAK-HARDWOOD-FOREST, BLACK-OAK-BARREN, and other dry, lightly wooded situations. One Hanes collection is from "somewhat moist soil along the Kalamazoo River E of Galesburg" (Hanes 1943).

***Arabis laevigata* (Willd.) Poiret**

Smooth Rock Cress

Current status uncertain. On banks and moist rises (sometimes called islands or levees) in SUGAR-MAPLE-FOREST in a matrix of otherwise typical FLOODPLAIN-FOREST near the Kalamazoo River.

***Arabis lyrata* L.**

Sand Cress

Common. BLACK-OAK-BARREN mostly in the W½ of the county.

***Arabis missouriensis* Greene**

Very rare. BLACK-OAK-BARREN and sandy OAK-HARDWOOD-FOREST in the W½ of the county. Most former sites for this species are no longer extant. All our specimens are of the var. *deamii*.

***Armoracia rusticana* Gaertn., Mey., & Scherb.**

Horseradish

Rarely escaped. Roadsides, ditches, and EM-MARSH.

***Barbarea verna* (Miller) Asch.**

Early Winter Cress

Current status unknown. Collected by the Haneses in 1935 and 1940 from several sites, all in the W½ of the county. Not since known. Not native.

***Barbarea vulgaris* R. Br.**

Yellow Rocket

Common. Open situations with moist soil. Widely established.

***Berteroa incana* (L.) DC.**

Hoary Alyssum

Occasional. RR rights-of-way, roadsides, and old fields. Widely established.

***Brassica kaber* (DC.) Wheeler**

Charlock; Wild Mustard

Occasional. Open disturbed ground of all kinds. Not native.

***Brassica napus* L.**

Rape; Rutabaga

Current status unknown. Known only from collections made by the Haneses on a farm in 1938, and from along a RR right-of-way in 1953. Not native. Not reported by the Haneses (1947).

***Brassica nigra* (L.) Koch**

Black Mustard

Current status unknown. Gardens, old fields, and other disturbed situations. Not native.

***Camelina microcarpa* DC.**

Small-fruited False Flax

Current status uncertain. Roadsides and old fields. Not native.

***Capsella bursa-pastoris* (L.) Medicus**

Shepherd's-purse

Common. Roadsides and other waste places. Widely established.

***Cardamine bulbosa* (Muhl.) BSP.**

Spring Cress

Current status uncertain. FEN, WET-MEADOW, and HARDWOOD-SWAMP.

***Cardamine douglassii* Britton**

Pink Spring Cress

Common. SUGAR-MAPLE-FOREST.

Cardamine pensylvanica Willd.

Pennsylvania Bittercress

Occasional. Locally abundant in TAMARACK-SWAMP and WET-MEADOW along Flowerfield Creek. The Haneses report plants from several additional sites that I have not revisited, including "near Shellman Lake" (Alamo Tp.), section 26 of Brady Tp., and section 26 of Wakeshma Tp.

Cardamine pratensis L.

Cuckoo-flower

Occasional. WET-MEADOW, FEN, RED-MAPLE-SWAMP, and TAMARACK-SWAMP, mostly in the S½ of the county.

Conringia orientalis (L.) Dumort.

Hare's-ear Mustard

Current status unknown. RR right-of-ways and roadsides. Not native.

Dentaria diphylla Michaux

Two-leaved Toothwort

Occasional. SUGAR-MAPLE-FOREST.

Dentaria laciniata Willd.

Cut-leaved Toothwort

Occasional. SUGAR-MAPLE-FOREST.

Descurainia pinnata (Walter) Britton

Tansy Mustard

Current status unknown. Collected by the Haneses from along a RR right-of-way 6 mi. SW of Schoolcraft. Not native.

Descurainia sophia (L.) Prantl

Current status unknown. Known only from a collection made by the Haneses from a RR right-of-way 1 mi. W of Vicksburg in 1953. Not native. Not in Hanes & Hanes (1947).

Draba reptans (Lam.) Fern.

Carolina Whitlow Grass

Extinct. Known only from a Hanes collection made from sandy soil along a RR right-of-way S of Portage (a region of former oak savanna). Collected in flower at this site on 30 April 1937 and with seeds on 6 May 1937. I have not been able to relocate plants in this area despite at least half a dozen searches. Reported by Brewer (1984) without a specimen, from the former right-of-way of the Michigan Central RR on the N edge of Genesee Prairie. This site has since been almost entirely overgrown with shrubs and trees. I have not found any plants here despite several searches.

Erophila verna (L.) Besser **Hanes:** *Draba verna*

Whitlow-grass

A common weed in lawns throughout. Widely established.

Erucastrum gallicum (Willd.) Schultz

Dog Mustard

Current status unknown. Collected by the Haneses from RR rights-of-way (Hanes 1939). Not native.

Erysimum cheiranthoides L.

Wormseed Mustard

Current status unknown. Moist soil along RR rights-of-way and roadsides. Both native and introduced plants probably occur in Kalamazoo County (Voss 1996).

Erysimum hieracifolium L. **Hanes:** *E. parviflorum*

Current status unknown. Known only from collections made in 1937 and 1939 by the Haneses. Not native.

Erysimum repandum L.

Treacle Mustard

Current status unknown. Collected by the Haneses (1933–1953) from along RR rights-of-way near Schoolcraft. Not native. Not in Hanes & Hanes (1947).

Hesperis matronalis L.

Dame's Rocket

Common. At woodland edges and in moist to wet lightly shaded situations along roadsides. Increasing in recent years (R. Brewer pers. comm. 2001). Not native.

Lepidium campestre (L.) R. Br.

Field Peppergrass

Occasional. Fields, roadsides, and RR rights-of-way. Not native.

Lepidium densiflorum Schrader **Hanes:** *L. apetalum*

Current status unknown. Collected by the Haneses from old fields and a RR right-of-way. Not native.

Lepidium perfoliatum L.

Perfoliate Peppergrass

Current status unknown. Collected by the Haneses from old fields and RR rights-of-way. Not native. First collected in 1935 (Hermann 1936).

Lepidium virginicum L.

Peppergrass

Current status uncertain. Old fields, roadsides, and RR rights-of-way.

Lunaria annua L.

Money-plant; Honesty

Occasional. First collected by E. M. Block on 18 May 1971. Widely cultivated. Has increased along roadsides and in waste places in the last few years. Not native. Not in Hanes & Hanes (1947).

Nasturtium officinale R. Br.

Watercress

Common. Streams and ditches. Widely established.

Raphanus raphanistrum L.

Wild Radish

Current status unknown. Collected by the Haneses from old fields in Section 29 Brady Tp. Not native.

Raphanus sativus L.

Radish

Current status unknown. Not native. Not in Hanes & Hanes (1947).

Rorippa palustris (L.) Besser **Hanes:** *R. islandica*

Marsh Cress

Current status uncertain. EM-MARSH.

Rorippa sylvestris (L.) Besser

Creeping Yellow Cress

Current status unknown. Collected by the Haneses from lawns and lakeshores. Not native.

Sisymbrium altissimum L.

Tumble Mustard

Current status unknown. Disturbed sandy situations. Not native.

Sisymbrium officinale (L.) Scop.

Hedge Mustard

Occasional. Roadsides and other open, disturbed situations. Rarely escaped.

Thlaspi arvense L.

Penny Cress

Occasional. RR rights-of-way and roadsides.

SARRACENIACEAE**Pitcher-plant Family***Sarracenia purpurea* L.

Pitcher-plant

Common. BOG and FEN sedge meadow.

DROSERACEAE**Sundew Family***Drosera intermedia* Hayne

Spatulate-leaved Sundew

Occasional. BOG. Thousands of plants carpet the black, acidic muck in trails and wet depressions at Bishop's BOG. Also relatively abundant at LeFevre BOG in Section 8 Climax Tp. Otherwise rare in open wet depressions in FEN sedge meadow. Collected by the Haneses from the E side of Austin Lake growing in peaty sand (this area was once dominated by an exceptionally species rich mosaic of COASTAL-PLAIN-MARSH, open OAK-HARDWOOD-FOREST, and damp, sandy/peaty WET-PRAIRIE and oak savanna).

Drosera rotundifolia L.

Round-Leaved Sundew

Common. Usually on the sides of hummocks of *Sphagnum* or sedge in FEN and BOG.**CRASSULACEAE****Orpine Family***Sedum acre* L.

Mossy Stonecrop

Locally established. Cemeteries and dry sandy disturbed situations.

Sedum telephium L. **Hanes:** *S. triphyllum*

Live-forever

Rarely escaped. Often persists on old homesites. Occasionally spreading to nearby thickets and forest edges.

Sedum ternatum Michaux

Current status unknown. Collected by the Haneses from a small sandy peninsula at Crooked Lake (Texas Tp.). Not native.

PENTHORACEAE**Ditch Stonecrop Family***Penthorum sedoides* L.

Ditch Stonecrop

Occasional. SHRUB-SWAMP, depressions in FEN, BOG moats, and ditches.

SAXIFRAGACEAE**Saxifrage Family***Chrysosplenium americanum* Hooker

Golden Saxifrage

Current status uncertain. Cool streams.

Heuchera richardsonii R. Br.

Alumroot

Rare. FEN, WET-PRAIRIE, HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and open, hilly OAK-HARDWOOD-FOREST. Some of our specimens approach *H. americana* L. (Voss 1985).

***Mitella diphylla* L.**

Bishop's-cap

Occasional. HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and SUGAR-MAPLE-FOREST.

***Mitella nuda* L.**

Naked Miterwort

Current status uncertain. Not recently collected or observed. Known only from Hanes collections in RED-MAPLE-SWAMP near Sugarloaf Lake, and from a forest in section 19 of Richland Tp.

***Parnassia glauca* Raf.**

Grass-of-Parnassus

Occasional. WET-MEADOW, FEN, seepage BOG (in alkaline microclimates), and along the otherwise marly shores of lakes and streams.

***Saxifraga pensylvanica* L.**

Swamp Saxifrage

Occasional. FEN and RED-MAPLE-SWAMP bordering lakes. Collected by the Haneses and by R. Brewer (1965) from WET-PRAIRIE, but no longer known from this nearly extinct plant community.

GROSSULARIACEAE**Gooseberry Family*****Ribes americanum* Miller**

Wild Black Currant

Occasional. SUGAR-MAPLE-FOREST.

Ribes cynobasti* L. Hanes: *Grossularia cynosbasti

Wild or Prickly Gooseberry

Current status uncertain. SUGAR-MAPLE-FOREST.

Ribes hirtellum* Michaux Hanes: *Grossularia hirtella

Swamp Gooseberry

Current status uncertain. Wet depressions in SUGAR-MAPLE-FOREST and HARDWOOD-SWAMP.

***Ribes odoratum* Wendl. f.**

Buffalo or Golden Currant

Rare. Roadsides and old homesites. Not native.

HAMAMELIDACEAE**Witch-hazel Family*****Hamamelis virginiana* L.**

Witch-hazel

Occasional. OAK-HARDWOOD-FOREST.

PLATANACEAE**Plane-tree Family*****Platanus occidentalis* L.**

Sycamore

Occasional. FLOODPLAIN-FOREST and HARDWOOD-SWAMP.

ROSACEAE**Rose Family**

This is a large and diverse family in Kalamazoo County. Several species in the difficult genera *Ame-lanchier*, *Crataegus*, and *Rubus* are reported here based only upon annotations made to herbarium specimens at WMU by E. G. Voss and mapped in Volume II. of Michigan Flora (1985).

The genus *Crataegus* is quite problematic in Kalamazoo County (and beyond). I have relied heavily on Voss (1985) in treating this genus. Several species reported in Hanes & Hanes (1947) are excluded from this treatment due to inadequate material or other similar problems (see Table 6).

The genus *Rubus* also presents a formidable challenge. To add to the confusion, several species have been described from Kalamazoo County (Hanes & Hanes 1947). Today, it seems best to treat this

genus in a rather conservative manner, such as was done by E. G. Voss (1985). The way I have treated the genus *Rubus* (relying heavily on the published distribution maps and synonyms provided by Voss 1985) seems practical for an annotated checklist such as this. When possible, I have indicated Hanes & Hanes (1947) synonyms.

***Agrimonia gryposepala* Wallr.**

Tall Agrimony

Common. FEN, WET-PRAIRIE, and OAK-HARDWOOD-FOREST.

***Agrimonia parviflora* Aiton**

Small-flowered Agrimony

Occasional. Thinly wooded and open WET-MEADOW, FEN, and SHRUB-CARR.

***Agrimonia pubescens* Wallr.**

Soft Agrimony

Occasional. OAK-HARDWOOD-FOREST and shady situations in all kinds of oak savanna.

***Agrimonia rostellata* Wallr.**

Very rare. First collected in Kalamazoo County by MNFI botanists at Fort Custer in 1994 from OAK-HARDWOOD-FOREST and associated sandy disturbed ground. So far known only from the NE¼ of the county, but potentially overlooked elsewhere. Not in Hanes & Hanes (1947).

***Amelanchier arborea* (Michaux f.) Fern.**

Juneberry

Occasional. Usually on relatively dry hillsides in OAK-HARDWOOD-FOREST, SUGAR-MAPLE-FOREST, and hillside prairie, often overlooking lakes. Some of the Haneses *A. laevis* is included here.

***Amelanchier interior* Nielsen**

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST. This species was included in the Haneses' (1947) *A. arborea*.

***Amelanchier laevis* Wieg.**

Shadbush Serviceberry

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Amelanchier spicata* (Lam.) K. Koch** **Hanes:** *A. humilis*

Occasional. Dry, often disturbed, and hilly OAK-HARDWOOD-FOREST.

***Aronia prunifolia* (Marsh.) Rehder**

Chokeberry

Current status uncertain. RED-MAPLE-SWAMP, BOG, TAMARACK-SWAMP, and rarely in low areas in otherwise drier forests. The Haneses' (1947) *Aronia melanocarpa* is included here since it is doubtfully distinct from *A. prunifolia* in Kalamazoo County (Voss 1985).

***Crataegus calpodendron* (Ehrh.) Medicus**

Current status unknown. The Haneses found this species to be relatively more common in the "E part of the county."

***Crataegus coccinea* complex**

Current status unknown. Collected by the Haneses from a diversity of situations in the W½ of the county. Includes the Haneses' (1947) *C. holmesiana*, and *C. pedicellata*.

***Crataegus crus-galli* L.**

Cockspur Thorn

"Infrequent" according to the Haneses (1947). Now occasional in pastures, old fields, and other disturbed situations.

Crataegus disperma Ashe

Current status unknown. Reported by the Haneses only from the F. W. Rapp woods in section 24 of Brady Tp. A portion of this forest has been converted to horse pasture.

Crataegus flabellata complex

Current status unknown. Collected by the Haneses from a diversity of situations throughout the county. Includes the Haneses' (1947) *C. gravis*, *C. macrosperma*, *C. multifida*, and probably *C. filipes*.

Crataegus intricata Lange

Current status unknown. OAK-HARDWOOD-FOREST in the W½ of the county.

Crataegus laevigata (Poiret) DC. **Hanes:** *C. oxycantha*

English Hawthorn

Current status unknown. One of only 3 collections assigned to this complex from the state. The only specimen from Kalamazoo County (5416 WMU) was collected by F. W. Rapp in 1941 at "Frank Reeds" marsh in Vicksburg where it was growing on a "sandy knoll." This specimen is sterile. Not native.

Crataegus margaretta Ashe

Current status unknown. Old fields, fencerows, and disturbed young forest.

Crataegus pruinosa (Wendl.) K. Koch.

Current status unknown. Collected by the Haneses from swamp borders and other unspecified forested situations. Includes the Haneses' (1947) *C. bellula*, *C. horridula* & *C. latiseipala*.

Crataegus punctata Jacq

Dotted Hawthorn

Occasional. SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, and old fields.

Crataegus succulenta Link

Current status unknown. Known from a single specimen collected in section 29 of Wakeshma Tp. by the Haneses.

Filipendula rubra (Hill) Robinson

Queen-of-the-prairie

Very rare. Once occasional in WET-PRAIRIE/WET-MEADOW along the Kalamazoo River and Portage Creek, and in lakeside FEN and SHRUB-CARR in Camp Custer. Now extirpated outside of Fort Custer (once called Camp Custer, and one of the same sites reported by the Haneses) where it is apparently being shaded out by other vegetation. Here it is associated with *Potentilla fruticosa*, *Scirpus acutus*, *Carex stricta*, and *Sorghastrum nutans* on muck (P. Higman pers. comm. 1997). Also once known from along the W branch of Portage Creek downstream from Milham Park (along the RR right-of-way), but this population was destroyed during sewer construction (R. Brewer pers. comm. 2001).

Fragaria virginiana Miller

Wild Strawberry

Occasional. In a diversity of more or less open habitats including old fields, OAK-HARDWOOD-FOREST, mesic to dry oak savannas, TERRESTRIAL-PRAIRIE, and WET-PRAIRIE.

The hybrid *Fragaria* × *anassa* (*F. virginiana* × *F. chiloënsis*), Common Cultivated Strawberry, was once known from the "Island" woods W of Schoolcraft and from "an orchard W of Schoolcraft" (Reported in Hanes & Hanes (1947) as *F. chiloënsis*). Current status unknown.

Geum aleppicum Jacq.

Yellow Avens

Occasional. WET-MEADOW and FEN, usually growing in muck.

***Geum canadense* Jacq.**

White Avens

Occasional. SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, and BLACK-OAK-BARREN.

***Geum laciniatum* Murray**

Rough Avens

Current status uncertain. WET-MEADOW.

***Geum rivale* L.**

Water Avens; Purple Avens

Occasional. TAMARACK-SWAMP, WET-MEADOW, FEN, and RED-MAPLE-SWAMP.

***Malus coronaria* (L.) Miller**

Wild, American, or Sweet Crab

Occasional. Fencerows, roadsides, and disturbed terrestrial forests.

***Malus pumila* Miller**

Apple

Occasional. Fencerows, roadsides, lakeshores, and disturbed terrestrial forests. Not native.

***Physocarpus opulifolius* (L.) Maxim.**

Ninebark

Current status uncertain. FLOODPLAIN-FOREST and HARDWOOD-SWAMP along the Kalamazoo River, Augusta Creek, and Spring Brook. Occasional in thickets along Arcadia (Bronson) Creek near the former right-of-way of the Michigan Central RR (est. before the area was cultivated) in former oak savanna (but may be adventive at this site). Appears to prefer slightly alkaline stream and river edges and occasionally adjacent wetlands. The Haneses report a shrub from E of Paw Paw Lake in a "swamp." Occasionally cultivated.

***Porteranthus trifoliatus* (L.) Britton**

Bowman's Root

Current status uncertain, very rare if still extant. Collected in 1978 by H. E. Ballard (the first collection for Michigan) "on the border of a clearing in oak woods in Schoolcraft Tp." (Ballard 1985; Voss 1985). There was a "small population" of plants at that time (H. E. Ballard pers. comm. 2002). Has not been relocated despite repeated attempts, but the exact former location remains to be identified with certainty.

***Potentilla anserina* L.**

Silverweed

Rare. Reported by the Haneses from several ponds on Prairie Ronde and from one other wetland site, the status of which is unknown. I am only aware of a few extant sites for this species in EM-MARSH on Prairie Ronde. Many former sites have been seriously altered by draining, pasturing, and cultivation.

***Potentilla argentea* L.**

Silvery Cinquefoil

Occasional. Dry disturbed situations.

***Potentilla arguta* Pursh**

Tall or Prairie Cinquefoil

Extinct. Collected by the Haneses from the SW $\frac{1}{4}$ of the county along roadsides through former TERRESTRIAL-PRAIRIE, in "Camp Custer", and "near Pretty Lake." Reported by Brewer (1984) from the former right-of-way of the MI Central RR on the N edge of Genesee Prairie. No longer extant at any of the aforementioned sites.

***Potentilla fruticosa* L.**

Shrubby Cinquefoil

Occasional. FEN and WET-MEADOW.

***Potentilla norvegica* L.**

Rough Cinquefoil

Occasional. RR rights-of-way, roadsides, and generally in dry, open, disturbed situations throughout.

Potentilla monspeliensis L. is included here. Both native *P. monspeliensis* and introduced *P. norvegica* appear to occur in Kalamazoo County. The two are scarcely distinct due to apparent hybridization and introgression (see Voss 1985).***Potentilla palustris* (L.) Scop.**

Marsh Cinquefoil

Occasional. FEN and wet depressions in BOG.

***Potentilla recta* L.**

Rough-fruited Cinquefoil

Occasional. RR rights-of-way, roadsides, and old fields, usually in sand. Invading disturbed BLACK-OAK-BARREN and open OAK-HARDWOOD-FOREST. Not native.

***Potentilla simplex* Michaux**

Common or Old-field Cinquefoil

Occasional. Sandy open situations.

***Prunus americana* Marsh.**

Wild Plum

Common. Terrestrial forests, fencerows, and old fields.

***Prunus avium* (L.) L.**

Sweet Cherry

Occasional. Collected by the Haneses from near a creek in section 31 of Schoolcraft Tp. Apparently not yet widespread at that time (1947). Not native. Mature trees can now be found throughout the county in sandy OAK-HARDWOOD-FOREST, especially near the city of Kalamazoo.

***Prunus cerasus* L.**

Sour or Pie Cherry

Current status unknown. Collected by the Haneses from the "Island" woods. Not native.

***Prunus domestica* L.**

Common Plum

Current status unknown. Collected by the Haneses from their property in Schoolcraft, and from near an old orchard, both in 1935. Not native. Not in Hanes & Hanes (1947).

***Prunus mahaleb* L.**

Perfumed Cherry

Locally established. First collected by Betty Muthiani on 16 May 1969 from sections 3, 4, 9, and 17 in Charleston Tp. Later collected 13 May 1976 from near Asylum Lake. Still locally established near Asylum Lake and no doubt elsewhere. Not native. Not in Hanes & Hanes (1947).

***Prunus nigra* Aiton**

Canada Plum

Locally established. First collected 1 June 1976 by M. McCann from a ridge E of Asylum Lake in section 30 of Kalamazoo Tp. Collected at this same site again in 1992. Not in Hanes & Hanes (1947).

***Prunus pensylvanica* L. f.**

Pin or Fire Cherry

Occasional. Sandy OAK-HARDWOOD-FOREST.

***Prunus persica* (L.) Batsch**

Peach

Rarely escaped along roadways.

Prunus pumila* L. Hanes: *P. susquehanae

Sand Cherry

Very rare. Collected by the Haneses from several sites in relatively dry former oak savanna. Now known only from a small population near Hampton Creek in a power line right-of-way passing through sandy overgrown former oak savanna. Other extant populations may persist, but this plant is now clearly very rare. All specimens are of the var. *susquehanae*.

***Prunus serotina* Ehrh.**

Wild Black Cherry

Common. Diverse terrestrial situations, especially sandy old fields, BLACK-OAK-BARREN, and fencerows.

***Prunus spinosa* L.**

Sloe; Blackthorn

Current status unknown. Collected by the Haneses from an old homesite and associated thicket in Texas Tp. Not native.

***Prunus virginiana* L.**

Choke Cherry

Occasional. SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, and fencerows.

***Pyrus communis* L.**

Pear

Rare. Fencerows, old fields, roadsides, and persisting on old homesites.

Rosa arkansana* Porter Hanes: *R. pratincola* & *R. suffulata

Prairie Rose

Current status unknown. Collected by the Haneses in 1936 from along a RR right-of-way. Possibly adventive.

***Rosa carolina* L.**

Pasture Rose

Occasional. Old fields, fencerows, RR rights-of-way, and roadsides.

***Rosa centifolia* L.**

Cabbage Rose

Current status unknown. Collected by the Haneses from roadsides and old homesites. May only persist where once cultivated.

***Rosa cinnamomea* L.**

Cinnamon Rose

Occasional. Roadsides, usually in relatively sandy soils. Not native.

Rosa eglanteria* L. Hanes: *R. rubiginosa

Sweetbrier

Current status unknown. Collected by the Haneses in 1936 from near the "Island" marsh just W of Schoolcraft, and by F. W. Rapp in 1940 from a roadside W of Vicksburg. Not native.

***Rosa gallica* L.**

French Rose

Current status unknown. Collected by the Haneses from roadsides and old homesites. Not native.

***Rosa multiflora* Murray**

Multiflora or Japanese Rose

Occasional. Often planted and frequently escaping from cultivation. Widely established.

***Rosa palustris* Marsh.**

Swamp Rose

Occasional. TAMARACK-SWAMP, RED-MAPLE-SWAMP, SHRUB-CARR, WET-MEADOW, and BOG.

***Rosa setigera* Michaux**

Prairie Rose

Extinct. Collected by the Haneses from the "Island" W of Schoolcraft. Collected by A. C. Roberts 1.5 mi. S of Kalamazoo by Portage St. and "the Lake Shore Michigan Southern Railway" on June 27 1899 (KVM). A few other reports from the county are apparently based on misidentified material. I am aware of no extant plants in Kalamazoo County. Probably once modal in open OAK-HARDWOOD-FOREST, prairie thickets, and oak savanna, but relatively little is known about this species in Kalamazoo County.

***Rosa spinosissima* L.**

Scotch Rose

Current status unknown. Collected by the Haneses from roadsides in section 14 of Cooper Tp. and section 16 of Ross Tp. Not native.

***Rubus alleghaniensis* Porter**

Common Blackberry

Common. Openings in SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, in "thickets," and generally in disturbed situations throughout. Includes the Haneses' (1947) *R. perspicuus* in part, *R. rappii*, and *R. rosa*.***Rubus canadensis* L.**Current status unknown. Collected by the Haneses (and reportedly "rare") near roadside ditches and in other disturbed relatively open situations in Brady, Climax, and Wakeshma Tps. May be introduced. Unusually far south here. No other collections are known from south lower Michigan (see Voss 1985). Includes the Haneses' (1947) *R. laetabilis*.***Rubus flagellaris* Willd.**

Northern Dewberry

Common. RR rights-of-way, BLACK-OAK-BARREN, and other open disturbed situations. I agree with Voss (1985) who suggests that several species may be grouped under this name. Includes the Haneses' (1947) *R. baileyanus*, *R. exutus*, *R. florenceae*, *R. meracus*, *R. michiganensis* (in part), *R. pauper* (in part), *R. schoolcraftianus*, *R. tantalus*, *R. tenuicaulis*, and *R. vagus*.***Rubus hispidus* L.**

Swamp Dewberry

Occasional. RED-MAPLE-SWAMP, TAMARACK-SWAMP, and ecotone between terrestrial forest and FEN, BOG, and WET-MEADOW. Includes the Haneses' (1947) *R. distinctus*, *R. kalamazooensis* (in part), and *R. plus*.***Rubus occidentalis* L.**

Black Raspberry

Occasional. Disturbed situations, including terrestrial roadsides, open SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, and fencerows.

***Rubus pensilvanicus* Poirlet Hanes:** *R. abactus*, *R. associus*, *R. cauliflorus*, *R. hanesii*, *R. licens*, *R. limulus*, *R. localis*, *R. michiganensis* (in part), *R. pauper* (in part), *R. uvidus*, and *R. variispinus* (in part).

Common. Almost any terrestrial situation imaginable except deeply shaded forest, including 10 meters above the ground in a large wind-damaged Black Oak!

***Rubus pubescens* Raf.**

Dwarf Raspberry

Occasional. TAMARACK-SWAMP and RED-MAPLE-SWAMP.

***Rubus setosus* Bigelow** **Hanes:** *R. conabilis*, *R. dissensus*, *R. jejunus*, *R. mediocris*, *R. perspicuus* (in part), *R. potis*, *R. variispinus* (in part), & *R. wheeleri*.

Occasional. Sandy old fields, BLACK-OAK-BARREN, and the sandy edges of EM-MARSH, FEN, and BOG. Voss (1985) suggests that several taxa may be grouped here.

***Rubus strigosus* Michaux**

Wild Red Raspberry

Occasional. Diverse, mostly terrestrial situations in full to partial sun.

***Sorbaria sorbifolia* (L.) A. Br.**

False Spiraea

Current status unknown. Roadsides and old homesites. Not native.

***Sorbus aucuparia* L.**

European Mountain-ash; Rowan

Current status unknown. A single tree was reported by the Haneses, "on the border of a swale in section 18 of Cooper Tp." This species is widely planted, but I have not seen it growing outside of cultivation in Kalamazoo County. Not native.

***Sorbus decora* (Sarg.) Schneider**

Showy Mountain Ash

Current status uncertain, very rare if still extant. Collected by the Haneses from section 30 of Charleston Tp., and mention is made of trees once known by H. R. Becker near Portage Lake (Charleston Tp.). Probably native, but here at the S edge of its known range in Michigan.

***Spiraea alba* Duroi**

Meadowsweet

Occasional. WET-PRAIRIE, FEN, WET-MEADOW, and SHRUB-CARR.

***Spiraea tomentosa* L.**

Hardhack; Steeplebush

Occasional. BOG, sandy acidic WET-PRAIRIE, WET-MEADOW, SHRUB-CARR, COASTAL-PLAIN-MARSH, and EM-MARSH. Typically more of an acidophile than *S. alba*.

LEGUMINOSAE (FABACEAE)

Pea Family

Several species in the genus *Desmodium* are reported here based primarily upon annotations made to herbarium specimens at WMU by E. G. Voss and mapped in Volume II. of Michigan Flora (1985).

***Amorpha canescens* Pursh**

Lead-plant

Rare. Collected from BLACK-OAK-BARREN, TERRESTRIAL-PRAIRIE, WHITE-OAK-SAVANNA, BUR-OAK-SAVANNA, and open OAK-HARDWOOD-FOREST, mostly in the W½ of the county, but probably an important component of all mesic to dry pre-European settlement terrestrial oak savanna and prairie plant communities. Now rare throughout in disturbed BLACK-OAK-BARREN, WHITE-OAK-SAVANNA, and OAK-HARDWOOD-FOREST. Declining due to widening of roadways, removal of fencerows, herbicide spraying and other disturbance along RR rights-of-way, development of oak savanna remnants, and fire suppression (resulting in canopy development in BLACK-OAK-BARREN, WHITE-OAK-SAVANNA, and formerly open OAK-HARDWOOD-FOREST). In 1989, a few plants from a former site at the intersection of I-94 and Oakland Dr. were transplanted to a BLACK-OAK-BARREN reconstruction on the W side of Angling Rd., just S of the

commuter lot near Centre St. This was prior to construction work under the direction of MDOT botanist, Kim Herman. Reported by A. C. Roberts to be persisting on Prospect Hill (former WHITE-OAK-SAVANNA) in downtown Kalamazoo on 11 July 1904 (KVM). No longer extant at this site. Lead-plant is usually a good indicator of relatively high quality savanna/prairie since it rarely persists following cultivation, and rarely establishes outside of remnant former prairie and savanna.

***Amorpha fruticosa* L.**

False Indigo

Current status unknown. Collected by C. R. Hanes from the Kellogg Forest on 23 June 1955. His notes read; "prolific escape" (MICH). Adventive. Not in Hanes & Hanes (1947).

***Amphicarpaea bracteata* (L.) Fern.**

Hog-peanut

Occasional. WET-PRAIRIE, OAK-HARDWOOD-FOREST edges, oak savanna, TERRESTRIAL-PRAIRIE, and generally along roadsides and RR rights-of-way.

***Apios americana* Medicus**

Groundnut; Wild-bean; Indian-potato

Occasional. FEN, WET-PRAIRIE, and other open moist situations, usually near lakes or streams.

***Astragalus canadensis* L.**

Canada Milk-vetch

Current status uncertain, very rare if still extant. Collected by the Haneses from the margin of the "Island" pond, and from the edge of Harrison Lake, both on Prairie Ronde. Not found in several site visits from 1995–2002.

***Astragalus neglectus* (T. & G.) Sheldon**

Cooper's Milk-vetch

Current status uncertain, very rare if still extant. Reported by the Haneses from the margin of "Patton's Marsh" (NW of Schoolcraft) and from a grassy clearing alongside Harrison Lake, both on Prairie Ronde. Most recently collected on 10 August 1954 by W. J. Gilbert (ALBC) from a roadside NW of Schoolcraft, possibly at one of the aforementioned sites. Not found in several site visits from 1995–2002.

Baptisia lactea* (Raf.) Thieret. Hanes: *B. leucantha

White Wild Indigo

Rare. Once relatively common, and still persisting locally on roadsides and along RR rights-of-way through former TERRESTRIAL-PRAIRIE and adjacent former oak savanna. Rapidly declining due to the removal of fencerows, widening of roads, poor seed set (pers. obs.), and herbicide spraying and other disturbance to RR rights-of-way.

***Baptisia leucophaea* Nutt.**

Cream Wild Indigo

Extinct. Collected by the Haneses from roadsides and RR rights-of-way on Prairie Ronde, and from the edge of a pond in overgrown oak savanna in Texas Tp. Collected by the first botanical survey on Grand Prairie, 1 August 1838 (NY). Last seen in Kalamazoo County by the Haneses in 1953. The few records from Kalamazoo County indicate that this species flowered in May, well before *B. lactea*, and set seed in mid-June.

***Baptisia tinctoria* (L.) R. Br.**

Yellow Wild Indigo

Current status uncertain, very rare if still extant. Known only from a Hanes collection made in open woods E of Mud Lake, Pavilion Tp. Some open OAK-HARDWOOD-FOREST and regenerating sandy old fields (resembling BLACK-OAK-BARREN) remain at this site, but I have not found any plants.

Cassia chamaecrista* L. Hanes: *C. fasciculata

Partridge-pea

Current status unknown. Collected by the Haneses from "the Grand Trunk Railway one mi. NE of Pavilion." Not native.

***Cassia hebecarpa* Fern.**

Wild Senna

Current status uncertain. Collected by the Haneses from near the Kalamazoo River on "Islands" and from undescribed situations in Cooper Tp., sections 23 and 24 of Comstock Tp., and "E of Galesburg." Collected by A. C. Roberts on 9 April 1899, 3 mi. N of Kalamazoo along a RR right-of-way and near "Riverside Cemetery" (KVM). Perhaps once a component of prairie and prairie-like openings along the Kalamazoo R.

***Cercis canadensis* L.**

Redbud; Judas Tree

Once relatively rare. Collected by the Haneses only from near the Kalamazoo River in SUGAR-MAPLE-FOREST and FLOODPLAIN-FOREST. Now occasional throughout, usually at wood edges. Both native and introduced plants now occur here.

***Coronilla varia* L.**

Crown-vetch

Common. Roadsides and RR rights-of-way. Often planted. A European introduction widely used for erosion control. Not native.

***Crotalaria sagittalis* L.**

Rattlebox

Collected by the Haneses from along a RR right-of-way E of Schoolcraft. No longer known. Probably adventive.

***Desmodium canadense* (L.) DC.**

Showy Tick Trefoil

Occasional. Moist to wet open situations including sandy WET-PRAIRIE and depressions in oak savanna.

***Desmodium canescens* (L.) DC.**

Hoary Tick Trefoil

Current status uncertain. Known only from collections made by the Haneses in 1944 and 1945 from "along a road through woods near the Nesbitt farm in Section 4 Prairie Ronde Tp.," the "Nesbitt woods," and "woods W of Twin lakes Alamo Tp."

***Desmodium ciliare* (Willd.) DC.**

Hairy Small-leaved Tick Trefoil

Current status uncertain. Collected by the Haneses from sandy soil at "Spring Brook along the C. K. & S. RR", "3 mi. E of Schoolcraft along the Grand Trunk RR," "NE of Crooked Lake," in Fort Custer, and in the Kleinstuck Reserve.

***Desmodium cuspidatum* (Willd.) Loudon**

Current status uncertain. Known only from a first survey collection made on 3 August 1838 in "dry openings" (MICH), and a Hanes specimen labeled *D. bracteosum* that was collected 26 August 1935 from "thickets and thin woods." The Hanes specimen has multiple locality labels; Swartz, Austin Lake, Eagle Lake, and N. of Paw Paw Lake (the first name on the label (Swartz) is probably where the specimen was collected).

***Desmodium glutinosum* (Willd.) Wood**

Pointed-leaved Tick Trefoil

Occasional. OAK-HARDWOOD-FOREST. Includes the Haneses' (1947) *D. bracteosum*.

Desmodium illinoense A. Gray

Illinois Tick Trefoil

Rare. Known from roadsides and RR rights-of-way, mostly in the SW¼ of the county.

Desmodium marilandicum (L.) DC.

Smooth Small-leaved Tick Trefoil

Current status unknown. Collected by the Haneses from the SW¼ of the county in "light sandy soil."

Desmodium nudiflorum (L.) DC.

Naked-flowered Tick Trefoil

Occasional. OAK-HARDWOOD-FOREST.

Desmodium obtusum (Willd.) DC. **Hanes:** *D. rigidum*

Rigid Tick Trefoil

Current status unknown. Collected by the Haneses from "... a sandy bank N of a small creek in section 6 of Portage Tp."

Desmodium paniculatum (L.) DC.

Panicked Tick Trefoil

Occasional. OAK-HARDWOOD-FOREST and disturbed BLACK-OAK-BARREN, but also in wetland edges and other habitats. Our specimens appear to be of both the var. *paniculatum* and the var. *dillenii* (the Haneses' (1947) *D. dillenii*).*Desmodium rotundifolium* DC. **Hanes:** *D. rotundiflorum*

Round-leaved Tick Trefoil

Occasional. Sandy OAK-HARDWOOD-FOREST.

Desmodium sessilifolium (Torrey) T. & G.

Sessile-leaved Tick Trefoil

Current status uncertain. Mostly in the W¼ of the county. Usually in the sandy soil of overgrown BLACK-OAK-BARREN and disturbed OAK-HARDWOOD-FOREST.

Gleditsia triacanthos L.

Honey Locust

Occasional. Mostly along the Kalamazoo River, but found sparingly elsewhere in moist to wet forests and disturbed situations. Probably adventive outside of FLOODPLAIN-FOREST and HARDWOOD-SWAMP in the vicinity of the Kalamazoo River and Augusta Creek. The Haneses collected the forma *inermis* (without spines) from forest E of Galesburg and in section 27 of Comstock Tp. I have not tried to relocate trees at either site. All of the trees I have seen of the forma *inermis* grow in disturbed situations and appear to be escapes from cultivation.*Gymnocladus dioica* (L.) K. Koch **Hanes:** *G. dioica*

Kentucky Coffee-tree

Rare. HARDWOOD-SWAMP in the SE¼ of the county. Most trees have their roots flooded in the spring, and most known sites are not far from small creeks. Probably once also occurred near the Kalamazoo River. Most extant native trees occur in N Wakeshma Tp. Occasionally planted.

Lathyrus latifolius L.

Perennial or Everlasting Pea

Rare to occasional. Escape from cultivation.

Lathyrus ochroleucus Hooker

Pale Vetchling

Occasional. Dry, relatively open OAK-HARDWOOD-FOREST primarily in the W¼ of the county.

***Lathyrus palustris* L.**

Marsh Pea

Occasional. WET-MEADOW, WET-PRAIRIE, FEN, SHRUB-CARR, and alongside lakes and ponds in EM-MARSH.

***Lathyrus venosus* Willd.**

Occasional. Dry, usually sandy soil along roadsides and RR rights-of-way, and in OAK-HARDWOOD-FOREST, TERRESTRIAL-PRAIRIE, and oak savanna.

***Lespedeza capitata* Michaux**

Common. TERRESTRIAL-PRAIRIE, oak savanna, and roadsides and RR rights-of-way through these plant communities.

***Lespedeza cuneata* (Dumont) G. Don**

Sericea

Current status unknown. Collected by the Haneses from section 20 of Oshtemo Tp., from E of Cooper, and from section 29 of Brady Tp. Not native.

***Lespedeza hirta* (L.) Hornem**

Common. BLACK-OAK-BARREN, OAK-HARDWOOD-FOREST, and open, sandy, disturbed ground. Most frequent in the W½ of the county.

The hybrid *L. hirta* × *L. intermedia* (the Haneses' *L. ×nutallii*) is known from Kalamazoo county. This hybrid has spreading hairs on the stem, but otherwise is quite similar to *L. intermedia* (Voss 1985).

***Lespedeza intermedia* (Watson) Britton**

Occasional. Hillsides in thinly wooded OAK-HARDWOOD-FOREST (including hillside prairie), in BLACK-OAK-BARREN, and in other relatively open, often sandy situations primarily in the W½ of the county. Known to hybridize with *L. hirta* (see *L. hirta*).

***Lespedeza stipulacea* Maxim.**

Korean Bush-clover

Current status unknown. Collected by the Haneses from a bank N of Pretty Lake and from a field near "Cooper's Glenn." Not native.

***Lespedeza violacea* (L.) Pers.**

Current status unknown. Collected by the Haneses from "wooded banks" (resembling hillside prairie, but with a nearly closed canopy). There are at least 6 previously known sites, all near or alongside lakes and streams in the central and W portions of the county.

***Lespedeza virginica* (L.) Britton**

Rare. Open OAK-HARDWOOD-FOREST and WHITE-OAK-SAVANNA, primarily in the W½ of the county.

Lotus corniculata

Birdfoot Treefoil

Occasional. Roadsides, RR rights-of-way, and similar open, disturbed situations. Not in Hanes & Hanes (1947). Not native.

***Lupinus perennis* L.**

Wild Lupine

Rare. BLACK-OAK-BARREN, openings in OAK-HARDWOOD-FOREST, and droughty WHITE-OAK-SAVANNA. Formerly common in the W½ of the county.

***Medicago lupulina* L.**

Black Medic

Common. Lawns, pastures, roadsides, and RR rights-of-way. Not native.

Medicago sativa L.

Alfalfa

Occasional. Roadsides, RR rights-of-way, old fields, and waste places. A yellow-flowered plant, long-known as *M. falcata* L. (the Haneses' (1947) *M. falcata*), Yellow-flowered Alfalfa, is probably closest to *M. sativa* (Voss 1985), and is included here despite some disagreement among taxonomists as to its actual specific status (Hanes 1938). The taxon known as ssp. *×varia* is also known from Kalamazoo County (Rabeler & Gereau 1983). Not native.

Melilotus alba Medicus

White Sweet-clover

Common. Disturbed, relatively open situations. Widely established.

Melilotus officinalis (L.) Pallas

Yellow Sweet-clover

Common. Disturbed, relatively open situations. Widely established.

Robinia hispida L.

Bristly Locust; Rose-acacia

Common. Roadsides and fencerows. Widely established.

Robinia pseudoacacia L.

Black Locust

Common. At wood edges, and almost everywhere else in droughty soils (Hanes 1956). Slowly invading our few remaining terrestrial oak savanna and TERRESTRIAL-PRAIRIE remnants. A serious threat to our prairie and savanna flora. Widely established.

Tephrosia virginiana (L.) Pers.

Goat's-rue; Rabbit-pea

Collected by the Haneses primarily from the W½ of the county in sandy BLACK-OAK-BARREN, and open OAK-HARDWOOD-FOREST. Now very rare in the same situations.

Trifolium arvense L.

Rabbitfoot Clover

Occasional. Lawns, roadsides, and old fields in dry sandy soil. Not native.

Trifolium aureum Poll. **Hanes:** *T. agrarium*

Hop Clover

Current status unknown. Known from many scattered collections. First collected by A. C. Roberts on 25 June 1898 from an unspecified location, probably near the city of Kalamazoo (KVM). Not native.

Trifolium campestre Schreber **Hanes:** *T. procumbens*

Low Hop Clover

Current status unknown. Collected by the Haneses from the lawn of the Kellogg Bird Sanctuary (Ross Tp.) and from S of Vicksburg. Not native.

Trifolium dubium Sibth.

Little Hop Clover

Occasional. Lawns and roadsides. Not native.

Trifolium hybridum L.

Alsike Clover

Occasional. Pastures and roadsides. Not native.

Trifolium pratense L.

Red Clover

Common. Lawns, gardens, old fields, roadsides, waste places, pastures, and RR rights-of-way. Not native.

***Trifolium repens* L.**

White Clover

Common. Roadsides, pastures, and lawns. Not native.

***Vicia americana* Willd.**

American Vetch

Occasional. Roadsides, RR rights-of-way, fencerows, and old fields.

***Vicia caroliniana* Walter**

Pale or Wood Vetch

Occasional. OAK-HARDWOOD-FOREST. Not native.

***Vicia cracca* L.**

Bird Vetch

Occasional. Roadsides, RR rights-of-way, and old fields. Not native.

Vicia sativa* L. Hanes: *V. cracca* & *V. angustifolia

Common or Spring Vetch

Current status unknown. Collected by the Haneses in Schoolcraft at the "RR station" in 1938, and by C. N. Harvey with no information except an annotation in her hand reading "in prairie." Not native.

***Vicia villosa* Roth.**

Hairy Vetch

Occasional. Roadsides, RR rights-of-way, and old fields. The ssp. *varia* was collected by the Haneses from an old RR right-of-way in section 7 of Texas Tp. (In Hanes & Hanes as *V. dasycarpa*). Not native.**LINACEAE****Flax Family*****Linum striatum* Walter**

Current status uncertain. Collected by the Haneses from "moist marshy meadows" on the N and S shores of Bonnie Castle Lake.

***Linum sulcatum* Riddell**

Extinct. The only collections known were made by the first botanical survey in 1838; one is from Grand Prairie, and another lacks habitat and locality data (MICH, NY). Not in Hanes & Hanes (1947).

***Linum usitatissimum* L.**

Common Flax

Current status unknown. Reportedly collected on 25 September 1903 from a pasture in Prairie Ronde Tp. This report comes from a ledger of specimens collected by a Mr. Burgess (first name unknown) "and sent to Chicago" (this ledger is filed in the Hanes herbarium at WMU). The only known extant herbarium specimen was collected by Ollie Hoyt on 5 August 1951 from along the GTRR right-of-way in Section 27 Prairie Ronde Tp. (WMU). Not native. Not in Hanes & Hanes (1947).

***Linum virginianum* L.**

Current status uncertain. Collected by the Haneses from remnant oak savanna, the shore of Sherman Lake, and a "low woodland on the E shore of Austin Lake."

OXALIDACEAE**Oxalis or Wood-sorrel Family*****Oxalis fontana* Bunge Hanes: *O. europaea***

Common. Lawns, gardens, and other relatively open disturbed situations.

***Oxalis stricta* L.**

Common. Disturbed, often sandy, but rarely dry, soil. More common in the W½ of the county than elsewhere. Collected from "rich prairie" near Schoolcraft in 1903 but not thought to be native.

GERANIACEAE**Geranium Family***Erodium cicutarium* L'Hér

Stork's-bill; Alfileria

Occasional. Roadsides, RR right-of-ways, lawns, and other disturbed situations. Widely established.

Geranium aequale Aedo

Known only from a collection made by R. W. Pippen in 1969 from the lawn in front of Siedschlag Hall on the WMU campus. Not native. Not in Hanes & Hanes (1947). Included in *G. molle* L. in Voss (1985).

Geranium carolinianum L.

Occasional. RR rights-of-way, roadsides, and lawns.

Geranium maculatum L.

Occasional. OAK-HARDWOOD-FOREST edges.

Geranium pusillum L.

Common. Gardens, roadsides, and lawns. Not native.

Geranium robertianum L.

Herb Robert

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

ZYGOPHYLLACEAE**Caltrop Family***Tribulus terrestris* L.

Caltrop; Puncture Vine

Current status unknown. Collected by the Haneses in 1936 from a RR right-of-way near Schoolcraft (Hanes 1938). Not native.

RUTACEAE**Rue Family***Ptelea trifoliata* L.

Hop-tree; Water-ash

Current status uncertain, very rare if still extant. Collected only by the Haneses from a fencerow in section 36 of Prairie Ronde Tp. No other collections are known.

Zanthoxylum americanum Miller

Prickly-ash

Common. ASH-SWAMP and occasionally other swamp forests.

SIMAROUBACEAE**Quassia Family***Ailanthus altissima* (P. Mill.) Swingle

Tree-of-Heaven

Common. Especially frequent in urban areas growing in waste places of all kinds. Persists in poor soils where few other woody plants will grow. Widely established.

POLYGALACEAE**Milkwort Family***Polygala cruciata* L.

Cross-leaved Milkwort

Very rare. COASTAL-PLAIN-MARSH. Once relatively common, but now nearly extinct. Decline is apparently due to shrub growth, stabilization of water levels, development, draining, and recreational damage to sandy lakeshores and marshes. A large population (thousands of plants) was reported by the Haneses on the "marshy edge of an ancient sand dune near the S shore of West Lake." I have been unable to relocate this site. The lakeshore of West Lake has since been altered significantly by development.

***Polygala polygama* Walter**

Racemed Milkwort

Occasional. BLACK-OAK-BARREN and OAK-HARDWOOD-FOREST.

***Polygala sanguinea* L.**

Field Milkwort

Occasional. BLACK-OAK-BARREN and sandy lakeshores.

***Polygala senega* L.**

Seneca Snakeroot; Senega Root

Rare. Collected by the Haneses from FEN, WET-PRAIRIE, TERRESTRIAL-PRAIRIE, and other undescribed moist to wet open situations. Today known only from prairie FEN.

***Polygala verticillata* L.**

Whorled Milkwort

Current status uncertain, very rare if still extant. Collected by the Haneses from BLACK-OAK-BARREN, dry sandy old fields, and from RR rights-of-way. Not since collected or observed.

EUPHORBIACEAE**Spurge Family*****Acalypha rhomboidea* Raf.**

Three-seeded Mercury

Occasional. Roadsides and other moist situations, but generally rather weedy everywhere.

***Croton monanthogynus* Michaux**

Prairie-tea

Current status uncertain. Collected by the Haneses from an "open wood near the N shore of Wyman Lake, Oshtemo Tp." (Hanes 1943). Native further W, this is the only known Michigan record for this species. An annual. Probably adventive.

***Euphorbia corollata* L.**

Flowering Spurge

Common. Old fields, oak savanna, TERRESTRIAL-PRAIRIE, roadsides, and RR rights-of-way.

***Euphorbia cyparissias* L.**

Cypress Spurge

Occasional. Roadsides and other waste places. May persist after cultivation. Not native.

***Euphorbia dentata* Michaux**

Toothed Spurge

Rare. Dry sandy situations including roadsides and RR rights-of-way. Not native.

***Euphorbia esula* L.**

Leafy Spurge

Occasional. Pastures, lawns, and waste places. Not native.

***Euphorbia glyptosperma* Engelm.**

Ridge-seeded Spurge

Occasional? Roadsides and RR rights-of-way, usually in dry, sandy soil.

Euphorbia maculata* L.**Occasional. Roadsides and other waste places. Includes the Haneses' (1947) *E. supina*.Euphorbia marginata* Pursh**

Snow-on-the-mountain

Current status uncertain. An escape from cultivation or just persisting where once cultivated.

Euphorbia nutans Lag.

Nodding Spurge

Occasional. Moist open situations such as in lawns. Reported (but without a specimen) as early as 1903 along RR rights-of-way in Schoolcraft. Not in Hanes & Hanes (1947). Included in the Haneses' (1947) *E. maculata*.

Euphorbia peplus L.

Petty Spurge

Rare. Lawns and roadsides. Locally established.

Euphorbia vermiculata Raf.

Petty Spurge

Current status uncertain. Moist open lawns and gardens. Not native. Not in Hanes & Hanes (1947).

LIMNANTHACEAE**False Mermaid Family***Floerkea proserpinacoides* Willd.

False Mermaid

Occasional. SUGAR-MAPLE-FOREST, primarily in the S½ of the county.

ANACARDIACEAE**Cashew Family***Rhus aromatica* Aiton

Fragrant Sumac

Very rare. Planted in "prairie plantings" at Oakland Dr. near the expressway, otherwise known only from "woods," a "slope," and "high ground above the W bank of Wintergreen Lake," all in the NE¼ SE¼ section 6 of Ross Tp. (KBSMS). Not in Hanes & Hanes (1947).

Rhus copallina L.

Shining or Dwarf Sumac

Occasional. Usually at OAK-HARDWOOD-FOREST edges, and in disturbed oak savanna (especially WHITE-OAK-SAVANNA).

Rhus glabra L.

Smooth Sumac

Occasional. Fencerows, roadsides, and wood edges. Usually in sandy soil.

The hybrid *Rhus* × *pulvinata* (*R. glabra* × *R. typhina*) is rare throughout in dry situations at OAK-HARDWOOD-FOREST edges.

Rhus typhina L.

Staghorn Sumac

Common. Old fields, forest edges, oak savanna, and RR rights-of-way and roadsides. Known to hybridize with *R. glabra* forming the named hybrid *Rhus* × *pulvinata* (see *R. glabra*).

Toxicodendron radicans (L.) Kuntze **Hanes:** *Rhus radicans*

Poison-ivy

Common. Occurs in a diversity of forested and open situations.

Toxicodendron vernix (L.) Kuntze **Hanes:** *Rhus vernix*

Poison Sumac

Common. SHRUB-CARR, FEN, BOG, RED-MAPLE-SWAMP, TAMARACK-SWAMP, SHRUB-SWAMP (associated with BOG or FEN), and BOG.

AQUIFOLIACEAE**Holly Family***Ilex verticillata* (L.) A. Gray

Michigan Holly; Winterberry; Black-alder

Occasional. FEN, TAMARACK-SWAMP, RED-MAPLE-SWAMP, WET-MEADOW, and BOG.

Nemopanthus mucronatus (L.) Loes. **Hanes:** *N. mucronata*

Mountain Holly; Winterberry; Black-alder

Occasional. BOG and SHRUB-CARR.

CELASTRACEAE

Bittersweet Family

Celastrus orbiculata Thunb.

Oriental Bittersweet

Rare. First collected 3 August 1994 by S. P. Grund and P. J. Higman on the E side of the Augusta/Climax Rd. approximately .1 mi. S of Mott Rd. in OAK-HARDWOOD-FOREST (MICH). Probably overlooked. Not native. Not in Hanes & Hanes (1947).

Celastrus scandens L.

Climbing or American Bittersweet

Occasional. Fencerows, HARDWOOD-SWAMP, FLOODPLAIN-FOREST, SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST.

Euonymus atropurpurea Jacq. **Hanes:** *E. atropurpureus*

Burning-bush; Wahoo

Very rare near the Kalamazoo River in FLOODPLAIN-FOREST and rich SUGAR-MAPLE-FOREST. Collected by the first botanical survey from along the Kalamazoo River.

Euonymus europaea L.

Spindle Tree

Rare. Recently disturbed situations, usually near old homesites. First reported outside of cultivation by Elliott (1960). Collected by P. Zager 24 May 1976 in section 30 of Kalamazoo Tp. at the NW end of Little Asylum Lake in a "low lying area." Not in Hanes & Hanes (1947).

Euonymus obovata Nutt. **Hanes:** *E. obovatus*

Running Strawberry-bush

Occasional. HARDWOOD-SWAMP, SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST.

STAPHYLEACEAE

Bladdernut Family

Staphylea trifolia L.

Bladdernut

Rare. FLOODPLAIN-FOREST, HARDWOOD-SWAMP, and SUGAR-MAPLE-FOREST.

ACERACEAE

Maple Family

Acer pseudoplatanus L. (Sycamore Maple) is known in Kalamazoo County from a single specimen of questionable status growing near the intersection of Drake Rd. and Crosstown Pkwy. Richard W. Phippen first brought this specimen to my attention in 1996. It is not treated separately below since it seems likely to have been planted.

Acer negundo L.

Box-elder; Ash-leaved or Manitoba Maple

Occasional. Native trees are occasional throughout, mostly in FLOODPLAIN-FOREST. Widely planted and escaped from cultivation to disturbed places, usually with mucky soils.

Acer platanoides L.

Norway Maple

Rare (perhaps overlooked). Apparently spreading, especially near mature planted trees. The heavy shade it produces is a threat to native vegetation (R. Brewer pers. comm. 2001). First collected by M. McCann 1 June 1976 in section 30 of Kalamazoo Tp. near a path on the E side of Asylum Lake. Not in Hanes & Hanes (1947).

Acer rubrum L.

Red Maple

Common. A diversity of swamp and terrestrial forest and shrub communities. Readily invades native upland forests in the absence of fire. An important component of RED-MAPLE-SWAMP.

Acer saccharinum L.

Silver Maple

Common. HARDWOOD-SWAMP (usually near streams) and FLOODPLAIN-FOREST.

Acer saccharum Marsh.

Sugar or Hard Maple

Common. SUGAR-MAPLE-FOREST. Actively invades OAK-HARDWOOD-FOREST in the absence of fire. Includes the Haneses' (1947) *A. nigrum* which is recognized by Voss (1985) as *A. saccharum* ssp. *nigrum* or ssp. *viride*.

HIPPOCASTANACEAE**Buckeye Family***Aesculus glabra* Willd.

Ohio Buckeye

Very rare. A few trees can be found in the "Island" woods W of Schoolcraft. No trees in the "Island" are greater than about 25 cm diameter at chest height, and most are much smaller. A single relatively large tree of questionable status grows in a fencerow on the N side of West Michigan Avenue W of Drake Rd.

Aesculus hippocastanum L.

Horse-chestnut

Rare. An escape from cultivation rarely found far from a mature planted tree.

BALSAMINACEAE**Touch-me-not Family***Impatiens capensis* Meerb. **Hanes:** *I. biflora*

Spotted Touch-me-not

Common. Mucky situations including HARDWOOD-SWAMP, TAMARACK-SWAMP, SHRUB-CARR, SHRUB-SWAMP, and WET-MEADOW.

Impatiens pallida Nutt.

Pale Touch-me-not

Occasional. Lightly disturbed areas in SUGAR-MAPLE-FOREST, especially at edges.

RHAMNACEAE**Buckthorn Family***Ceanothus americanus* L.

New Jersey Tea

Occasional. OAK-HARDWOOD-FOREST, WHITE-OAK-SAVANNA, BLACK-OAK-BARREN, roadsides, and RR rights-of-way.

Rhamnus alnifolia L'Hér.

Alder-leaved Buckthorn

Occasional. FEN, seepage BOG, and occasionally in other swampy situations.

Rhamnus cathartica L.

Common Buckthorn

Occasional. OAK-HARDWOOD-FOREST, and dry, often clayey old fields. Can form large even-aged stands. Not native.

Rhamnus frangula L. Glossy Buckthorn

Occasional. Will colonize even relatively undisturbed wetlands with apparent ease. Especially abundant in Bishop's Bog where it forms impenetrable, even-aged thickets. Very few native plants survive in the heavy shade it produces. Locally established and spreading.

VITACEAE**Grape Family**

Parthenocissus inserta (A. Kerner) Fritsch

Occasional. Forest edges and fencerows.

Parthenocissus quinquefolia (L.) Planchon

Virginia Creeper

Common. All kinds of forest.

Vitis aestivalis Michaux

Summer Grape

Occasional. SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, WET-PRAIRIE, and oak savanna.

Vitis labrusca L.

Fox Grape

Current status uncertain. Fencerows, thickets, RR rights-of-way, and dry OAK-HARDWOOD-FOREST edges. Not in Hanes & Hanes (1947).

Vitis riparia Michaux

River-bank Grape

Common. FLOODPLAIN-FOREST, HARDWOOD-SWAMP, SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, and wooded roadsides.

TILIACEAE**Linden Family**

Tilia americana L.

Basswood; Linden

Occasional. FLOODPLAIN-FOREST and SUGAR-MAPLE-FOREST.

MALVACEAE**Mallow Family**

Abutilon theophrasti Medicus

Velvet-leaf

Common. Fields, roadsides, and RR rights-of-way. Widely established.

Alcea rosea L. **Hanes:** *Althaea rosea*

Hollyhock

Rare. A presumed escape from cultivation in fencerows and waste ground.

Hibiscus moscheutos L.

Rose or Swamp Mallow

Current status uncertain, very rare if still extant. First collected 15 Aug 1978 from a single large individual in an old field near Augusta. From 1998–2001 two large plants grew near the location of the first report in ballast along a RR right-of-way. These plants did not come up in 2002, and during a careful search of the surrounding area in late summer (2002) I failed to locate any plants. Probably adventive. Not in Hanes & Hanes (1947).

Hibiscus trionum L.

Flower-of-an-hour

Rare. Gardens, roadsides, and RR rights-of-way. Not native.

Malva alcea L.

Vervain Mallow

Current status unknown. Collected by the Haneses mostly from roadsides and RR rights-of-way. Not native.

Malva moschata L.

Musk Mallow

Rare. Roadsides throughout. Not native.

***Malva neglecta* Wallr.**

Common Mallow; Cheeses

Common. Lawns and other open situations. Widely established.

GUTTIFERAE (CLUSIACEAE) (Hanes: HYPERICACEAE)**St. John's-wort Family*****Triadenum fraseri* (Spach) Gl. Hanes: *Hypericum virginicum* var. *fraseri***

Marsh St. John's-wort

Occasional. FEN, peaty COASTAL-PLAIN-MARSH, and BOG. This "species" is scarcely discernable from the next in BOG on the W side of West Lake. I follow Voss (1985) in recognizing the two here as distinct entities.

Triadenum virginicum* (L.) Raf. Hanes: *Hypericum virginicumRare. BOG W of West Lake. Also reported by the Haneses from the shores of Weeds and Thrall Lakes (see *T. fraseri*) (Hanes & Hanes 1947).***Hypericum ascyron* L.**

Giant St. John's-wort

Current status uncertain. Collected by the Haneses from thinly wooded and open "marshes." Not since collected or observed.

***Hypericum boreale* (Britton) Bickn.**

Occasional. WET-MEADOW, lakeshores, and sandy EM-MARSH.

***Hypericum canadense* L.**

Current status unknown. Collected by the Haneses from a "marshy meadow one mi. W of Pine Island Lake," and a "marsh border" in Schoolcraft Tp.

***Hypericum gentianoides* (L.) BSP.**

Orange-grass

Current status uncertain, very rare if still extant. Collected by the Haneses from "a marsh" near a RR right-of-way in section 7 of Brady Tp. in 1936. Associates included *Spiraea tomentosa*, "Hair-cap Moss" (*Polytrichum* sp.), and *Populus*. Collected by the Haneses from one other site in relatively dry soil near a RR right-of-way. Reported by the Haneses to be declining at the Brady Tp. site.***Hypericum majus* (A. Gray) Britton**

Current status unknown. Collected by the Haneses from lakeshores.

***Hypericum mutilum* L.**

Current status unknown. Collected by the Haneses from WET-MEADOW.

***Hypericum perforatum* L.**

Common St. John's-wort; Klamath Weed; Goatweed

Common. Disturbed situations along roadsides, RR rights-of-way, and in old fields. Widely established.

***Hypericum prolificum* L.**

Shrubby St. John's-wort

Common. Open OAK-HARDWOOD-FOREST, and in dry-mesic to mesic disturbed BLACK-OAK-BARREN and WHITE-OAK-SAVANNA. Apparently more frequent in the NW¼ of the county than elsewhere.

***Hypericum punctatum* Lam.**

Spotted St. John's-wort

Occasional. BOG, FEN, RED-MAPLE-SWAMP, and TAMARACK-SWAMP.

CISTACEAE**Rockrose Family*****Helianthemum bicknellii* Fern.**

Rockrose

Rare. Not as frequent or widespread as *H. canadense*. Known only from sandy former oak savanna and old fields in the W½ of the county. Often co-occurs with *H. canadense*.

***Helianthemum canadense* (L.) Michaux**

Frostweed

Occasional. Sandy soil along RR rights-of-way, in old fields and oak savanna, and at open edges with OAK-HARDWOOD-FOREST.

***Lechea minor* L.**

Thyme-leaved Pinweed

Extinct. Collected by the Haneses from sandy oak savanna along a RR right-of-way, a "moist sandy flat at the base of an oak grove near the S shore of Eagle Lake," and from along a RR right-of-way E of Schoolcraft. Last observed in 1946. All former sites are destroyed, or have been searched by the author, unsuccessfully, for several years.

Lechea pulchella* Raf. Hanes: *L. leggettii

Extinct. First collected by L. A. Kenoyer in 1930 from "sandy shores" at Austin Lake (Hermann 1936). Later also collected there by the Haneses. The Haneses made this note about the Austin Lake site, "It [*L. pulchella*] is fairly frequent intermittently for almost a mile along the beach in the open or in thin oak woods". Last observed in 1954 along the sandy E shore of Austin Lake. The shoreline of Austin Lake has been heavily developed since 1954.

***Lechea stricta* Britton**

Current status uncertain, very rare if still extant. A sterile specimen collected from dry soil along a RR right-of-way E of Schoolcraft by W. B. Drew et al. (M126 MSC) in 1947 is referred here by Voss (1985). Similar to *L. intermedia* which is not known from Kalamazoo County. Not in Hanes & Hanes (1947).

***Lechea villosa* Ell.**

Hairy Pinweed

Occasional. Dry sandy soil along RR rights-of-way, and roadsides, and in BLACK-OAK-BARREN and sandy WHITE-OAK-SAVANNA, primarily in the W½ of the county.

VIOLACEAE**Violet Family**

This is a large and diverse family in Kalamazoo County. I have relied heavily on annotations to herbarium specimens made by E. G. Voss, and H. E. Ballard to identify our many species. Several of the below named hybrids are reported solely based upon their inclusion in Ballard (1994).

***Hybanthus concolor* (T. F. Forster) Sprengel**

Green Violet

Current status uncertain, very rare if still extant. Reported by the Haneses from N of the Kalamazoo River and extending along it to the E on elevated "islands" (levees) of moist forest (SUGAR-MAPLE-FOREST) in a matrix of mature FLOODPLAIN-FOREST. Reported by H. E. Ballard (ca. 1983) to persist in a few places on the aforementioned levees (H. E. Ballard pers. comm. 2002).

***Viola affinis* Le Conte**

Occasional. FEN, WET-MEADOW, open RED-MAPLE-SWAMP, and other swampy situations near lakes and streams.

***Viola arvensis* Murray**

Field Pansy

Occasional. Fields, RR rights-of-way, and roadsides. Not native.

Viola blanda* Willd. Hanes: *V. incognita

Sweet White Violet

Occasional. Wet depressions in TAMARACK-SWAMP, RED-MAPLE-SWAMP, BOG, and FEN.

***Viola canadensis* L.**

Canada Violet

Common. SUGAR-MAPLE-FOREST.

Viola conspersa* Reichb. Hanes: *V. labradorica

Dog Violet

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

The named hybrid *Viola ×malteana* (*V. conspersa* × *V. rostrata*) is rare throughout in ecotone between OAK-HARDWOOD-FOREST and wetlands, where the putative parents grow near one another (Ballard 1994).

***Viola cucullata* Aiton**

Marsh Violet

Common. FEN, open and lightly wooded WET-MEADOW, SHRUB-SWAMP (usually associated with BOG moats), and SHRUB-CARR.

***Viola lanceolata* L.**

Lance-leaved Violet

Occasional. COASTAL-PLAIN-MARSH, sandy WET-PRAIRIE, WET-MEADOW, and BOG. Hybridizes with *V. sagittata* in sandy WET-PRAIRIE/COASTAL-PLAIN-MARSH in Alamo Tp.***Viola macloskeyi* F. E. Lloyd Hanes: *V. pallens***

Smooth White Violet

Occasional. FEN, BOG, and SHRUB-CARR.

***Viola nephrophylla* Greene**

Occasional. FEN, seepage BOG, SHRUB-CARR, and marly lakeshores.

***Viola odorata* L.**

English or Sweet Violet

Common. Lawns, gardens, suburban woods, and cemeteries. Hybridizes with several of our native violets. Not native.

Viola palmata* L. Hanes: *V. triloba

Wood Violet

Rare. Damp sandy depressions in OAK-HARDWOOD-FOREST and oak savanna, including sandy WET-PRAIRIE. Ballard (1994) suggests that some, if not all plants, may be of hybrid origin. The parentage may involve *V. sagittata* and *V. lanceolata*, but several entities including hybrids involving *V. pedatifida* are probably lumped under this name (Ballard 1994; Voss 1985).

***Viola pedata* L.**

Birdfoot Violet

Rare. Relatively intact and open BLACK-OAK-BARREN and sandy former WHITE-OAK-SAVANNA, primarily in the W½ of the county. Declining due to habitat loss. Seems to thrive at sites where the substrate is subject to occasional minor disturbance, such as along lightly used trails.

***Viola pedatifida* G. Don**

Prairie Violet

Very rare. RR rights-of-way and roadsides through former TERRESTRIAL-PRAIRIE. Collected along RR rights-of-way in Schoolcraft (where it still persists) as early as 6 June 1902. I observed a plant with cleistogamous flowers typical of *V. pedatifida*, but with entire leaves, growing near typical *V. pedatifida* along the GTRR right-of-way south of XY Avenue in 1997. It may be a hybrid. Prairie violet is not known in Kalamazoo County from outside the boundaries of former TERRES-

TRIAL-PRAIRIE (known from Gull Prairie, Prairie Ronde, and Gourdneck Prairie). I am not even aware of sites from within BUR-OAK-SAVANNA bordering former TERRESTRIAL-PRAIRIE. Prairie Violet has declined markedly in Kalamazoo County in recent years due to lack of management of the few remaining prairie remnants, and inadequate protection (loss of fencerows, widening of roads, and disturbance to TERRESTRIAL-PRAIRIE RR rights-of-way and cemeteries through bulldozing, narrowing, herbicide application, etc.).

The hybrid *Viola* \times *subsiniuata* (*V. pedatifida* \times *V. sororia*) is rare in Harrison Cemetery in Prairie Ronde Tp. growing amidst its putative parents.

***Viola pubescens* Aiton**

Yellow Violet

There are two widely recognized varieties: var. *pubescens* (Downy Yellow Violet) and var. *scabriuscula* (Smooth Yellow Violet). Both are common throughout in OAK-HARDWOOD-FOREST, SUGAR-MAPLE-FOREST and FLOODPLAIN-FOREST. The two vars. sometimes occur in the same forest, suggesting they may best be treated as two species. Includes the Haneses' (1947) *V. pennsylvanica*.

***Viola rostrata* Pursh**

Long-spurred Violet

Occasional. OAK-HARDWOOD-FOREST and relatively dry situations in SUGAR-MAPLE-FOREST.

The hybrid *Viola* \times *brauniae* (*V. rostrata* \times *V. striata*) is rare throughout in ecotone at the edge of HARDWOOD-SWAMP and FLOODPLAIN-FOREST (Ballard 1994). Also known to hybridize with *V. conspersa* forming the named hybrid *Viola* \times *malteana* (see *V. conspersa*).

***Viola sagittata* Aiton**

Arrow-leaved Violet

Occasional. BLACK-OAK-BARREN, OAK-HARDWOOD-FOREST, and moist to wet sand along roadsides, in old fields, and in other sandy, moist, and relatively open situations. White flowered plants are relatively common. All known specimens are of the var. *sagittata*.

***Viola sororia* Willd.**

Common Blue Violet

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. Less frequent in swamp forests. Includes the Haneses' (1947) *V. papilionacea*.

***Viola striata* Aiton**

Cream Violet

Occasional. FLOODPLAIN-FOREST. Especially common along trails. Known to hybridize with *V. rostrata* forming the named hybrid *Viola* \times *brauniae* (see *V. rostrata*).

***Viola tricolor* L.**

Johnny-jump-up

Locally established. Roadsides. Especially common (1996) in disturbed ground above the steam pipes on the WMU campus. Not native. Not in Hanes & Hanes (1947).

CACTACEAE

Cactus Family

***Opuntia humifusa* (Raf.) Raf.**

Prickly Pear Cactus

Current status uncertain, very rare if still extant. Collected by the Haneses from section 24 of Cooper Tp. in sandy soil (former oak savanna). I have been unable to relocate plants in this area, but much potential habitat remains unsearched. A few individuals grow in a BLACK-OAK-BARREN reconstruction S of the commuter lot at the intersection of Centre St. and US 131 in Portage. The origin of these plants is unknown.

THYMELAEACEAE**Mezereum Family***Dirca palustris* L.

Leatherwood

Occasional. Rich, moist SUGAR-MAPLE-FOREST and ASH-SWAMP.

ELAEAGNACEAE**Oleaster Family***Elaeagnus angustifolia* L.

Russian-olive

Occasional. A diversity of moist open situations, especially roadsides. Widely established.

Elaeagnus umbellata Thunb.

Occasional. Old fields and other disturbed situations. Widely established.

LYTHRACEAE**Loosestrife Family***Decodon verticillatus* (L.) Ell.

Whorled or Swamp Loosestrife

Common. On the margin of lakes, streams, and rivers in BOG, EM-MARSH, and FEN.

Lythrum alatum Pursh

Winged Lythrum

Current status uncertain. Known primarily from the S½ of the county in EM-MARSH.

Lythrum salicaria L.

Purple Loosestrife

Common. WET-MEADOW, SHRUB-SWAMP, EM-MARSH, COASTAL-PLAIN-MARSH, in ditches, and in almost all other relatively open, wet situations. First reported by Elliott (1960) from along Augusta Creek in Ross Tp. and from the SW shore of Mud (Stony) Lake. Not in Hanes & Hanes (1947). Widely established and spreading, especially where once dynamic water levels have been stabilized or otherwise manipulated (such as in most of the formerly species rich COASTAL-PLAIN-MARSHES at Eagle Lake (pers. obs.)).

Rotala ramosior (L.) Koehne

Tooth-cup

Rare. Collected by the Haneses from EM-MARSH of ponds and lakeshores where the substrate is sand or peaty sand and where water levels fluctuate seasonally. Sometimes in COASTAL-PLAIN-MARSH. Mostly limited to the W½ of the county. The Haneses observed that plants were much more common after fire. Now absent from several former sites, and rare and local elsewhere. Perhaps declining at least in part due to fire suppression and stabilization of once dynamic water levels.

NYSSACEAE Hanes: Included in CORNACEAE**Tupelo Family***Nyssa sylvatica* Marsh.

Sour-gum; Black-gum; Pepperidge

Occasional. Peaty and/or sandy acid substrates in HARDWOOD-SWAMP and lightly wooded OAK-HARDWOOD-FOREST, usually near current or former lakeshores.

MELASTOMATACEAE**Melastome Family***Rhexia virginica* L.

Meadow-beauty

Current status uncertain, very rare if still extant. Collected by the Haneses from Eagle Lake and Pine Island Lake. May be extinct at Eagle Lake (well surveyed in 1996–1997 and sporadically since). Status at Pine Island Lake is uncertain.

ONAGRACEAE**Evening-primrose Family**

Several species of *Oenothera* are reported here based only on annotations made by E. G. Voss and/or because they are mapped in his treatment of this genus for Volume III of Michigan Flora (1996).

***Circaea alpina* L.**

Enchanter's-nightshade

Current status uncertain. RED-MAPLE-SWAMP. Particularly common in the vicinity of the Sugarloaf Lakes. Included in the Haneses' (1947) *C. quadrisulcata*.

***Circaea lutetiana* L.**

Enchanter's-nightshade

Occasional. FLOODPLAIN-FOREST, SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-Forest. Often especially abundant in young second growth forests near wetlands. Not in Hanes & Hanes (1947). Included in the Haneses' (1947) *C. quadrisulcata*.

***Epilobium angustifolium* L.**

Fireweed; Great Willow-herb

Only occasionally encountered as a local element of relatively acidic disturbed wetlands. Once "common" in Bishop's Bog, but now only occasionally encountered there (Hanes & Hanes 1947). Reported by the Haneses to thrive after burning in WET-MEADOW and other wetlands.

Epilobium ciliatum* Raf. Hanes: *E. adenocaulon

Northern Willowherb

Collected by the Haneses from the "sandy shore of Pretty Lake," and a "swamp in Section 14 Charleston Tp."

***Epilobium coloratum* Biehler**

Purple-leaved Willowherb

Current status uncertain. Known from a diversity of wetland ecotones.

***Epilobium hirsutum* L.**

Great Hairy Willow-herb

Rare. First Michigan collection was made by H. R. Becker "1.5 mi. NE of Portage" in 1943 (Hanes 1945b). Occurs in WET-MEADOW, along lakeshores and roadsides, and in wet, old fields.

***Epilobium leptophyllum* Raf.**

Linear-leaved Willow-herb

Collected by the Haneses from the BOG east of Sugarloaf Lake, and from a streamside. The only relatively recent report that I am aware of is from a "marsh" at the Nature Conservancy Augusta Floodplain Forest Preserve (Meagher & Tonsor 1992).

***Epilobium strictum* Sprengel**

Downy Willow-herb

Current status uncertain. FEN.

***Gaura biennis* L.**

Very rare. Disturbed former TERRESTRIAL-PRAIRIE/BUR-OAK-SAVANNA. The only extant plants I have seen in Kalamazoo County grow on the N side of the current RR right-of-way through the WMU campus (1996), not far from the intersection of Stadium Dr. and Oliver St., and very near if not within the right-of-way of the former MI Central RR. The plants are associated with *Ratibida pinnata*, *Silphium integrifolium* and weedy exotics in mesic loam. Most of the plants were destroyed by herbicide spraying and clearing in 1997. Not in Hanes & Hanes (1947), but added to the margin of their personal annotated copy.

***Gaura coccinea* Pursh**

Collected for the first time in the county by the Haneses in 1953. Not in Hanes & Hanes (1947), but added to the margin of their personal annotated copy. Collected by the author from a RR right-of-way W of Schoolcraft in 1996 where a few months later it was killed by herbicide (not seen again since). Probably adventive.

Ludwigia alternifolia L.

Seedbox

Current status uncertain, very rare if still extant. Collected by the Haneses from a "swamp NE of Vicksburg in Section 7 Brady Tp."

Ludwigia palustris (L.) Eill.

Water-purslane

Occasional. EM-MARSH and depressions associated with FEN, BOG, and WET-MEADOW.

Ludwigia polycarpa Short & Peter

Current status unknown. EM-MARSH of ditches, the edges of lakes, and in ponds.

Oenothera clelandii Dietrich, Raven, & W. L. Wagner **Hanes:** *O. rhombipetala*

Rhombic Evening Primrose

Occasional. Disturbed, sandy former BLACK-OAK-BARREN, especially near Pretty, Eagle, and Crooked Lakes in Texas Tp. Known only from the west half of Kalamazoo County.

Oenothera fruticosa L. **Hanes:** *O. tetragona*.

Sundrops

Current status unknown. Collected by the Haneses from a diversity of mostly disturbed situations.

Oenothera laciniata Hill

Cut-leaved Evening Primrose

Occasional in a diversity of sandy situations including former BLACK-OAK-BARREN.

Oenothera parviflora L. **Hanes:** *O. cymatilis* (in part)

Evening Primrose

Current status unknown. Collected by the Haneses from old fields, roadsides, and RR rights-of-way. Not in Hanes & Hanes (1947).

Oenothera villosa Thunb. **Hanes:** *O. biennis*, *O. canovirens*, *O. cymatilis* (in part), *O. muricata*, & *O. pycnocarpa*

Current status unknown. Collected by the Haneses from old fields, roadsides and RR rights-of-way, and from a sandy lake border. Not in Hanes & Hanes (1947).

HALORAGACEAE**Water-milfoil Family***Myriophyllum exalbescens* Fern.

Spiked Water-milfoil

Occasional. SUB-MARSH of lakes and streams.

Myriophyllum heterophyllum Michaux

Various-leaved Water-milfoil

Occasional. SUB-MARSH of lakes.

Myriophyllum tenellum Bigelow

Slender Water-milfoil

Collected by the Haneses from SUB-MARSH at Eagle and Pretty Lakes. Now occasional at Pretty and Crooked Lakes, and probably also in Eagle Lake, in SUB-MARSH. The aforementioned oligotrophic lakes have sandy bottoms. The plants I have seen in Crooked and Pretty Lakes were growing in less than 50 cm of water, and could be easily observed during the low water levels of the fall of 1999. This species is here at the S edge of its known range.

Myriophyllum verticillatum L.

Whorled Water-milfoil

The Haneses note that this species is "rare in most of our ponds and lakes." Still widely distributed, and though probably not common, it is easily overlooked.

***Proserpinaca palustris* L.**

Mermaid-weed

Occasional on lake borders, especially EM-MARSH bordering ponds with fluctuating water levels, and usually associated with peaty/sandy substrates.

HIPPURIDACEAE**Mare's-tail Family*****Hippuris vulgaris* L.**

Mare's-tail

Extinct. Collected by the first botanical survey in 1838 (MICH). Not since known from S Lower Michigan.

ARALIACEAE**Ginseng Family**

Aralia elata (Miq.) Seem. has been collected several times from near the intersection of B Ave. and 45th St. in Kalamazoo, where it was probably once cultivated. It was last collected at this site on 27 July 1977. The Hanes do not report this species in their flora. Since the status of these collections is uncertain, and since the label data are inconclusive on this matter, I have not included *Aralia elata* in the checklist below.

***Aralia hispida* Vent.**

Bristly Sasparilla

Rare. BOG and associated TAMARACK-SWAMP.

***Aralia nudicaulis* L.**

Wild Sasparilla

Occasional. OAK-HARDWOOD-FOREST, SUGAR-MAPLE-FOREST, and RED-MAPLE-SWAMP.

***Aralia racemosa* L.**

Spikenard

Occasional. Rich HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and SUGAR-MAPLE-FOREST.

***Panax quinquefolius* L.**

Ginseng; Sang

Rare. Rich HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and SUGAR-MAPLE-FOREST. Planted in "Holcomb's Woods," SW of Fulton (K. Chapman, MNFI Site survey report 1980).

Panax trifolius* L. Hanes: *P. trifolium

Dwarf Ginseng

Occasional. SUGAR-MAPLE-FOREST.

UMBELLIFERAE (APIACEAE)**Carrot or Parsley Family*****Aegopodium podagraria* L.**

Goutweed

Current status unknown. Collected by the Haneses from the H. R. Becker yard in Charleston Tp. Not native.

***Anethum graveolens* L.**

Dill

Current status unknown. Collected by the Haneses from a "roadside near the H. R. Becker farm in Charleston Tp." Not native.

***Angelica atropurpurea* L.**

Purple-stemmed Angelica

Occasional. WET-PRAIRIE, WET-MEADOW, and FEN. Usually associated with *Spartina pectinata*.

Angelica venenosa (Greenway) Fern.

Hairy Angelica

Very rare. Collected by the Haneses from overgrown WHITE-OAK-SAVANNA and from thin OAK-HARDWOOD-FOREST (former WHITE-OAK-SAVANNA). Now restricted to a single site, NW of the intersection of Drake Rd. and US 131 in WHITE-OAK-SAVANNA. Here it is abundant (hundreds of stems) and associated with other rare and interesting oak savanna plants. This site lies in or near the edge of the former right-of-way of the Michigan Central RR.

Anthriscus sylvestris (L.) Hoffm.

Chervil

Current status unknown. Known outside of cultivation in Michigan only from Kalamazoo County. Collected from roadsides and disturbed OAK-HARDWOOD-FOREST. First collected 30 May 1953 by G. Parmelee in section 6 of Ross Tp. "N of road past the MSC Bio Station entrance . . . on low ground adjacent to water-lily pond" (MSC). Not native. Not in Hanes & Hanes (1947).

Berula erecta (Hudson) Cov. **Hanes:** *B. pusilla*

Cut-leaved Water Parsnip

Rare. Especially in rich sediment along streams through FEN meadow. Flowering usually occurs from late June into August. Especially common in the vicinity of the Sugarloaf Lakes and Hampton Creek (both in the Gourdneck State Game Area).

Carum carvi L.

Caraway

Current status unknown. Collected by the Haneses on 13 June 1945 from a roadside in section 26 of Wakeshma Tp. Not native.

Chaerophyllum procumbens (L.) Crantz

Wild-chervil

Very rare. Known only from FLOODPLAIN-FOREST near the Kalamazoo River where it is rare in moist depressions.

Cicuta bulbifera L.

Bulblet Water Hemlock

Occasional. Wet depressions, especially alongside lakes and streams.

Cicuta maculata L.

Water Hemlock

Occasional. WET-PRAIRIE, open RED-MAPLE-SWAMP, FEN, open swamp forest, wet ditches, and quite generally almost anywhere in wet depressions.

Conioselinum chinense (L.) B.S.P.

Hemlock-parsley

Rare. Usually growing singly in TAMARACK-SWAMP and RED-MAPLE-SWAMP.

Conium maculatum L.

Poison-hemlock

Occasional. Roadsides, RR rights-of-way, and other disturbed situations.

Cryptotaenia canadensis (L.) DC.

Honestwort

Current status uncertain. SUGAR-MAPLE-FOREST, especially following disturbance (R. Brewer pers. comm. 2001).

Daucus carota L.

Wild Carrot; Queen-Anne's-lace

Common. Most relatively open disturbed situations, especially old fields. Widely established.

***Erigenia bulbosa* (Michaux) Nutt.**

Harbinger-of-spring

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Eryngium yuccifolium* Michaux**

Rattlesnake-master

Very rare. Collected by the Haneses and others from WET-PRAIRIE, TERRESTRIAL-PRAIRIE, BUR-OAK-SAVANNA, and wet to wet-mesic depressions in BLACK-OAK-BARREN and WHITE-OAK-SAVANNA. Most records are from ecotone at wetland edges with prairie or oak savanna, but this may just represent the distribution of less-disturbed, relatively open sites where specimens persisted. Most substrates were loamy sand or sandy loam. Probably once modal in wet-mesic and WET-PRAIRIE. Of the 10 or more distinct populations known by the Haneses (some very large), only one small population remains. At least half of the aforementioned populations were still extant as recently as 1980. Most former sites have since succeeded to forest/shrubs and a few have been destroyed by changes in land use. In 1997 11 stems, only one of which flowered, could be found at the one remaining site. In 2002, one stem again flowered, but only six stems were observed in the area. The site had been partly overgrown by shrubs. This population has probably persisted in part because past visitors to the site (over the last 30+ years) have removed portions of woody debris that shaded the plants (R. W. Pippen pers. comm.; pers. obs.). I have done this several times myself over the last nine years. There appears to be a correlation between removal of the shade-producing woody debris and flowering in this population (R. W. Pippen pers. comm. 1996, pers. obs.). This site is in a sandy Consumers Power right-of-way (est. 1954) at the interface between overgrown oak savanna (now open OAK-HARDWOOD-FOREST) and FEN/SHRUB-CARR in the Gourdneck State Game Area (Sytsma & Pippen 1982a). Overuse by recreators, and especially herbicide application may have contributed to the relatively recent deterioration of this once very species rich site (pers. obs., R.W. Pippen pers. comm.). Perhaps the largest known population post Hanes (1947) occurred in WET-PRAIRIE along the right-of-way of the former MI Central RR along Arcadia Creek near the WMU campus. Much of this site is now under the current Stadium Drive (completed between 1962–1964). Unfortunately, shrub and tree growth shaded out the few plants that persisted after the aforementioned “improvement” of Stadium Drive (Brewer 1965, R. Brewer pers. comm.). No plants remain in the area, but timely management may permit the recovery of at least a few plants from the seed bank.

***Foeniculum vulgare* Miller**

Fennel

Collected only by the Haneses in 1952 and 1953 from along the GTRR near Schoolcraft. Not in Hanes & Hanes (1947). Not native.

Heracleum maximum* Bartram Hanes: *H. lanatum

Cow-parsnip

Occasional. RED-MAPLE-SWAMP, FEN, and along streams, in a variety of lightly shaded to open wet situations.

***Hydrocotyle americana* L.**

American Pennywort

Occasional. Shady wet situations, usually not far from open or running water.

***Hydrocotyle umbellata* L.**

Umbellate Pennywort

Occasional. Usually found near the shores of sandy-bottomed streams and lakes including COASTAL-PLAIN-MARSH. Especially frequent in the SW¼ of the county.

***Osmorhiza claytonii* (Michaux) C. B. Clarke**

Wooly Sweet Cicely

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

***Osmorhiza longistylis* (Torrey) DC.**

Smooth Sweet Cicely

Occasional. Rich, often relatively wet SUGAR-MAPLE-FOREST.

Oxypolis rigidior (L.) Raf.

Cowbane

Occasional. FEN, WET-MEADOW, and openings in RED-MAPLE-SWAMP. Usually near lakes or streams.

Pastinaca sativa L.

Wild Parsnip

Rarely escaped from cultivation along roadsides in disturbed loamy soils.

Sanicula canadensis L.

Short-styled Snakeroot

Occasional? HARDWOOD-SWAMP and relatively wet SUGAR-MAPLE-FOREST.

Sanicula gregaria Bickn.

Clustered Snakeroot

Occasional. A diversity of habitats including SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, RED-MAPLE-SWAMP, and FEN.

Sanicula marilandica L.

Black Snakeroot

Occasional. Rich HARDWOOD-SWAMP, SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST.

Sanicula trifoliata Bickn.

Large-fruited Snakeroot

Current status uncertain. SUGAR-MAPLE-FOREST.

Sium suave Walter

Water-parsnip

Occasional. Usually near lakes and streams in HARDWOOD-SWAMP, RED-MAPLE-SWAMP, and TAMARACK-SWAMP.

Taenidia integerrima (L.) Drude

Yellow-pimpernel

Occasional. SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST, and especially overgrown former sandy oak savanna.

Thaspium trifoliatum (L.) A. Gray

Meadow Parsnip

Extinct. Collected by the Haneses from WHITE-OAK-SAVANNA (growing very close to former terrestrial prairie) and TERRESTRIAL-PRAIRIE.

Zizia aurea (L.) Koch

Golden Alexanders

Occasional. FEN, WET-MEADOW, WET-PRAIRIE, and TERRESTRIAL-PRAIRIE. Collected by the Haneses from banks along a RR right-of-way through Prairie Ronde. Probably once also occurred in wet to wet-mesic oak savanna.

CORNACEAE**Dogwood Family***Cornus alternifolia* L. f.

Alternate-leaved or Pagoda Dogwood

Rare to Occasional. Stream borders in thickets, often at the shady interface between OAK-HARDWOOD-FOREST and FEN.

Cornus amomum Miller **Hanes:** *C. obliqua*

Pale Dogwood

Common. BOG, WET-MEADOW, FEN, SHRUB-SWAMP, SHRUB-CARR, WET-PRAIRIE, and TAMARACK-SWAMP, often at the margin of lakes, streams, and rivers.

***Cornus canadensis* L.**

Bunchberry; Dwarf Cornel

Current status uncertain. Collected by the Haneses from four distinct sites in the county; "... damp woods N of Sugarloaf Lake, ... Shaffer's oak woods NE of Goose Lake, ... a low woodland along Flowerfield Creek in section 20 of Prairie Ronde Tp., and ... Alamo Tp." I have been unable to relocate plants at Sugarloaf Lake and Goose Lake. I have not searched for plants at the other sites.

***Cornus florida* L.**

Flowering Dogwood

Occasional. Rich hilly SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST. Usually found in areas where the forest canopy is relatively open such as on hillsides overlooking lakes, streams, and other wetlands (including hillside prairie).

Cornus foemina* Miller Hanes: *C. racemosa

Gray Dogwood

Common. Droughty former oak savanna, OAK-HARDWOOD-FOREST, old fields, and other disturbed situations.

***Cornus rugosa* Lam.**

Round-leaved Dogwood

Collected by the Haneses from "a bank on the S shore of Pretty Lake," and near a roadside on the SE shore of Stony Lake. Still extant (1999) at Pretty Lake on a steep hillside (hillside prairie) between the lakeshore and open OAK-HARDWOOD-FOREST. Status at Stony Lake is unknown.

***Cornus stolonifera* Michaux**

Red-osier

Common. SHRUB-CARR, FEN, SHRUB-SWAMP, BOG, and WET-MEADOW.

PYROLACEAE (Hanes: ERICACEAE)**Shinleaf or Wintergreen Family*****Chimaphila maculata* (L.) Pursh**

Spotted Wintergreen

Once relatively rare, but now occasional throughout. Sandy soils of relatively open, disturbed OAK-HARDWOOD-FOREST and shrubby former BLACK-OAK-BARREN. The reason this species has increased significantly in frequency and abundance in recent years is unknown, but may be related to fire suppression.

***Chimaphila umbellata* (L.) W. P. C. Barton**

Pipsissewa; Prince's-pine

Occasional. Rich OAK-HARDWOOD-FOREST, usually near wetlands. Less common than *C. maculata*.

Orthilia secunda* (L.) House Hanes: *Pyrola secunda

One-sided Shinleaf

Current status uncertain, very rare if still extant. Known from a collection at the Kalamazoo Valley Museum made by A. C. Roberts 3.5 mi. SW of Kalamazoo on 25 June 1899 (KVM), and from a collection made by the Haneses in "an oak wood on the dry bank of a cat hole in section 32 of Texas Tp." (Hanes 1950). Not since collected or observed.

***Pyrola asarifolia* Michaux**

Liver-leaved Wintergreen

Collected by the Haneses from TAMARACK-SWAMP "N of Sugarloaf Lake" and "in the swamp N of Mud Lake, Pavilion Tp." No longer known at Sugarloaf Lake. Status at Mud Lake is uncertain.

***Pyrola elliptica* Nutt.**

Shinleaf

Occasional. Typically in moist depressions at the interface between sandy OAK-HARDWOOD-FOREST and wetlands. In similar situations as the next species, but less frequently encountered.

Pyrola rotundifolia L.

Round-leaved Wintergreen

Occasional. Depressions in sandy OAK-HARDWOOD-FOREST, usually near wetlands.

MONOTROPACEAE (Hanes: Included in ERICACEAE)**Indian-pipe Family***Monotropa hypopithys* L.

Pinesap; False Beech-drops

Current status uncertain. OAK-HARDWOOD-FOREST.

Monotropa uniflora L.

Indian-pipe

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST.

ERICACEAE**Heath Family***Andromeda glaucophylla* Link

Bog-rosemary

Occasional. BOG.

Arctostaphylos uva-ursi (L.) Sprengel

Bearberry; Kinnikinnick

Extinct. Collected by the Haneses from "open dunes" (probably sandy BLACK-OAK-BARREN) on the E side of Austin Lake. This site has been intensively developed. No other populations have ever been known.

Chamaedaphne calyculata (L.) Moench

Leatherleaf

Common. BOG.

Epigaea repens L.

Trailing-arbutus

Current status uncertain, very rare if still extant. Dry hillside OAK-HARDWOOD-FOREST in the W½ of the county near wetlands. Last observed by H. E. Ballard in the early 1980s (H. E. Ballard pers. comm. 2002).

Gaultheria hispida (L.) Bigelow **Hanes: *Chiogenes hispida***

Creeping-snowberry

Current status uncertain, very rare if still extant. The Haneses (1947) report this species was "rare" in the "swamp" E of Sugarloaf Lake. They say that they had collected "berries," but at a later date were unable to relocate the plants to secure a specimen for the herbarium. This site may now be flooded.

Gaultheria procumbens L.

Teaberry; Wintergreen

Occasional. Sandy OAK-HARDWOOD-FOREST.

Gaylussacia baccata (Wangenh.) K. Koch

Huckleberry; Crackleberry

Occasional. OAK-HARDWOOD-FOREST, BOG, and TAMARACK-SWAMP, on sandy peat, or on shallow peat with underlying sand. Appears to be about equally as frequent in dryer situations as in swampy ones.

Vaccinium angustifolium Aiton **Hanes: *V. lamarckii* & *V. brittonii***

Low Sweet Blueberry

Collected by the Haneses from an "oak wood NE of Goose Lake," and "oak woods" in Texas Tp. Now also known from Hampton Lake where it grows in rich TAMARACK-SWAMP with *C. acaule*. Probably overlooked. The forma *nigrum* (*V. brittonii* in Hanes & Hanes (1947)) was reported by the Haneses to grow with the typical forma NE of Goose Lake on a sandy rise of ground with oaks. This form is more common than would appear from the few collections in herbaria.

***Vaccinium corymbosum* L.**

Highbush Blueberry

Common. BOG, TAMARACK-SWAMP, SHRUB-CARR, and relatively open situations in RED-MAPLE-SWAMP.

Vaccinium macrocarpon* Aiton Hanes: *Oxycoccus macrocarpus

Large Cranberry

Common. BOG.

***Vaccinium myrtilloides* Michaux**

Velvetleaf or Canada Blueberry

Occasional. OAK-HARDWOOD-FOREST, especially near wetlands.

Vaccinium oxycoccus* L. Hanes: *Oxycoccus palustris

Small Cranberry

Common. BOG. Especially abundant in open *Sphagnum* in the wet "sedge mat."***Vaccinium pallidum* Aiton Hanes: *V. vacillans***

Low Sweet Blueberry

Occasional. Dry, sandy situations in open OAK-HARDWOOD-FOREST, especially at edges.

PRIMULACEAE**Primrose Family*****Anagallis arvensis* L.**

Common or Scarlet Pimpernel

Current status unknown. Gardens, roadsides, and other disturbed situations.

***Lysimachia ciliata* L.**

Fringed Loosestrife

Occasional. Wet depressions, lakeshores, and at the margins of streams, growing in EM-MARSH, FEN, BOG, and WET-MEADOW.

***Lysimachia lanceolata* Walter**

Lance-leaved Loosestrife

Occasional in a diversity of lakeshore wetlands.

***Lysimachia nummularia* L.**

Moneywort

Occasional. A diversity of moist to wet disturbed situations. Sometimes exceedingly abundant in lawns and along lakeshores. Readily invades COASTAL-PLAIN-MARSH, WET-MEADOW, and swampy forest edges. Not native.

Lysimachia quadriflora* Sims Hanes: *L. longifolia

Narrow-leaved Loosestrife

Occasional. FEN and WET-MEADOW along alkaline shorelines. Sometimes locally abundant in light shade under open-grown tamarack.

***Lysimachia quadrifolia* L.**

Whorled Loosestrife

Occasional. Sandy overgrown oak savanna and OAK-HARDWOOD-FOREST, especially in the vicinity of the Hampton Creek Wetlands Complex. Does not appear to persist long after canopy closure; thus, it is a good indicator of quality (perhaps recoverable) former oak savanna (now OAK-HARDWOOD-FOREST).

The fertile hybrid *Lysimachia* ×*producta* ×*L. quadrifolia* (*L. terrestris*) was collected by the Haneses from a peaty TAMARACK-SWAMP NE of Goose Lake. Current status unknown.***Lysimachia terrestris* (L.) BSP. Hanes: *L. producta***

Swamp-candles

Very rare. Collected by the Hanes from a "tamarack swamp" NE of Goose Lake "where it is scarce."

A collection was made by A. C. Roberts in 1900 (KVM), and this species is reported by Meagher and Tonsor (1992) from "marsh" at the Augusta Floodplain Forest Preserve. No other collections are known from Kalamazoo County. A hybrid with *L. quadrifolia* (*Lysimachia* \times *producta* (see *L. quadrifolia*)) is known from Kalamazoo County.

***Lysimachia thyrsiflora* L.**

Tufted Loosestrife

Occasional. WET-MEADOW, FEN, EM-MARSH, and SHRUB-CARR.

***Trientalis borealis* Raf.**

Star-flower

Occasional. TAMARACK-SWAMP, ASH-SWAMP, BOG, and RED-MAPLE-SWAMP.

OLEACEAE

Olive Family

***Fraxinus americana* L.**

White Ash

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST.

***Fraxinus nigra* Marshall**

Black Ash

Common. Most kinds of swamp forest, but especially ASH-SWAMP and RED-MAPLE-SWAMP.

***Fraxinus pennsylvanica* Marshall**

Red or Green Ash

Occasional. HARDWOOD-SWAMP and FLOODPLAIN-FOREST.

***Fraxinus quadrangulata* Michaux**

Blue Ash

Rare. Rich, relatively wet SUGAR-MAPLE-FOREST and HARDWOOD-SWAMP. Often associated with *Asimina triloba* and *Celtis occidentalis*.

***Ligustrum vulgare* L.**

Common Privet

Collected by the Haneses from a "thicket on the N shore of Woods Lake, Kalamazoo Tp." Plants are occasionally encountered throughout Kalamazoo County, usually in disturbed shrubby situations. Not native.

***Syringa vulgaris* L.**

Common Lilac

Occasional outside of cultivation in a diversity of disturbed habitats including forest edges and old fields. Locally established.

GENTIANACEAE

Gentian Family

***Bartonia virginica* (L.) B.S.P.**

Yellow Bartonia

Rare. Acid swampy situations including BOG, RED-MAPLE-SWAMP, and TAMARACK-SWAMP, growing in peaty sand or *Sphagnum*.

Frasera caroliniensis* Walter Hanes: *Swertia carolinensis

American Columbo

Collected by the Haneses from overgrown WHITE-OAK-SAVANNA, and formerly open OAK-HARDWOOD-FOREST. Now occasional throughout at the edges of overgrown dry-mesic to mesic savannas that have succeeded to closed-canopy OAK-HARDWOOD-FOREST (primarily WHITE-OAK-SAVANNA, especially on outwash near TERRESTRIAL-PRAIRIE). A long-lived monocarpic perennial. Plants may persist as a rosette of leaves in a vegetative state for more than 30 years in S Carolina, and doubtless here too. Probably once modal in mesic and species rich WHITE-OAK-SAVANNA and adjacent prairie. Frequently associated with *Arnoglossum atriplicifolium* which, like

this species, has declined significantly since publication of the Haneses' 1947 flora (Hanes & Hanes 1947; Threadgill et al. 1979; Threadgill et al. 1981).

Gentiana alba* Nutt. Hanes: *G. flavida

White Gentian

Extinct. Reported by the Haneses from "two mi. S of Portage in dry oak woods" (woods along the "Smith huckleberry marsh" at Weeds Lake in section 32 of Portage Tp., a former oak savanna), and from "the border of a cat hole in Section 28 Texas Tp." Probably once an occasional component of rich oak savanna and mesic prairie.

***Gentiana andrewsii* Griseb.**

Closed or Bottle Gentian

Occasional. FEN, SHRUB-CARR, WET-MEADOW, and WET-PRAIRIE.

Gentianella quinquefolia* (L.) Small Hanes: *Gentiana quinquefolia

Stiff Gentian

Very rare. Alkaline FEN and WET-MEADOW in the E½ of the county.

Gentianopsis crinita* (Froel.) Ma Hanes: *Gentiana crinita

Fringed Gentian

Very rare. Sandy WET-MEADOW and WET-PRAIRIE. Most sites have at least mildly alkaline substrates. Most plants have been seen in the W½ of the county.

Gentianopsis procera* (Holm) Ma Hanes: *Gentiana procera

Smaller Fringed Gentian

Occasional. FEN, SHRUB-CARR, moist sandy old fields, and sometimes alkaline WET-MEADOW. Difficult to discern from, but much more frequent than, *G. crinita*.

***Sabatia angularis* (L.) Pursh**

Rose-pink; Rose Gentian

Rare. Sandy lakeshores in COASTAL-PLAIN-MARSH. Collected by the Haneses outside of the SW¼ of the county, but to my knowledge now limited to just a few sites, all in Texas Tp.

MENYANTHACEAE (Hanes: Included in GENTIANACEAE)

Buckbean Family

***Menyanthes trifoliata* L.**

Buckbean; Bogbean

Occasional. Wet depressions in BOG and FEN.

APOCYNACEAE

Dogbane Family

***Apocynum androsaemifolium* L.**

Spreading Dogbane

Occasional. RR rights-of-way, in oak savanna, and at OAK-HARDWOOD-FOREST edges.

The hybrid *Apocynum × floribundum* (*A. androsaemifolium* × *A. cannabinum*) is rare throughout in sandy BLACK-OAK-BARREN, and WHITE-OAK-SAVANNA. Called *A. × medium* by the Haneses (1947).

***Apocynum cannabinum* L.**

Indian-hemp

Occasional. Sandy wet areas alongside roads and RR rights-of-way, FEN, WET-PRAIRIE, and moist to wet depressions in oak savanna. Includes the Haneses (1947) *A. sibiricum*. Known to hybridize with *A. androsaemifolium* forming the named hybrid *Apocynum × floribundum* (see *A. androsaemifolium*).

***Vinca minor* L.**

Periwinkle; "Myrtle"

Common. A diversity of shaded, disturbed situations, usually not far from former plantings. Not native.

ASCLEPIADACEAE**Milkweed Family*****Asclepias amplexicaulis* Sm.**

Clasping-leaved Milkweed

Collected by the Haneses from BLACK-OAK-BARREN, WHITE-OAK-SAVANNA, openings in OAK-HARDWOOD-FOREST, roadsides, RR rights-of-way, and TERRESTRIAL-PRAIRIE. Now rare throughout in similar habitats.

Asclepias exaltata* L. Hanes: *A. phytolaccoides

Poke Milkweed

Rare. Disturbed SUGAR-MAPLE-FOREST, open OAK-HARDWOOD-FOREST, and other lightly wooded situations, especially near lakes. Just N of the county line, and slightly E of Gull Lake, this species was exceedingly abundant in 1998 following selective logging in a hilly SUGAR-MAPLE-FOREST (approx. 50% of the canopy had been removed).

Asclepias hirtella* (Pennell) Woodson Hanes: *Acerates hirtella

Prairie Milkweed

Extinct. Known only from a Hanes collection made on the edge of a "white and black oak woodland" on the south boundary of section 36 of Schoolcraft Tp. A few extant sites for this species (1997) occur just south of Kalamazoo County (Porter Tp., St. Joseph Co.) in disturbed former TERRESTRIAL-PRAIRIE and oak savanna.

***Asclepias incarnata* L.**

Swamp Milkweed

Common. Ditches, FEN, WET-MEADOW, WET-PRAIRIE, and other wet, open situations at pond and stream edges, in pastures, and along lakeshores.

***Asclepias purpurascens* L.**

Purple Milkweed

Very rare. Collected by the Haneses from several sites in former oak savanna (sandy BLACK-OAK-BARREN, open OAK-HARDWOOD-FOREST, and WHITE-OAK-SAVANNA) in the S½ of the county. Now nearly extinct. In 1996 I located three blooming plants (no seed was produced) each with 1–3 stems. These were growing on the edge of a degraded OAK-HARDWOOD-FOREST (remnant WHITE-OAK-SAVANNA) in section 28 of Texas Tp (see cover). In 1997 and 1998 the plants were covered with yard waste. Only one stem reappeared in 1999, and no flowers were produced. No other additional sites are known, and other previously known sites have been heavily disturbed, destroyed, now have heavy forest canopy cover, or are otherwise no longer known. Probably once modal in level, mesic WHITE-OAK-SAVANNA and thickets in TERRESTRIAL-PRAIRIE.

***Asclepias syriaca* L.**

Common Milkweed

Common. Open to lightly shaded disturbed situations (but never in heavy shade), especially in old fields and along RR rights-of-way.

***Asclepias tuberosa* L.**

Butterfly-weed

Occasional. RR rights-of-way, roadsides, remnant TERRESTRIAL-PRAIRIE, and oak savanna. *Asclepias tuberosa* ssp. *interior* with leaves broadest above the middle, and cuneate at the base, is by far the most common variety here. *Asclepias tuberosa* ssp. *tuberosa* is much rarer, but has become more frequent since the 1940's when the Haneses were aware of only a single site. *Asclepias tuberosa* f. *lutea* is rare throughout. I suspect that most if not all f. *lutea*, especially along roadsides, are only persisting where once planted or are progeny from cultivated plants.

***Asclepias verticillata* L.**

Whorled Milkweed

Collected by the Haneses from BLACK-OAK-BARREN and TERRESTRIAL-PRAIRIE along roadsides and RR rights-of-way. Now common throughout along expressway rights-of-way and highway roadsides where it may benefit from frequent mowing and mild salinity. In some places lit-

erally tens of thousands of stems carpet the expressway median and/or roadside (McKenna 2002). Easily overlooked.

Asclepias viridiflora* Raf. Hanes: *Acerates viridiflora

Green Milkweed

Very rare. Collected by the Haneses and others from oak savanna, an open OAK-HARDWOOD-FOREST (including hillside prairie), and once especially frequent on roadsides and along RR rights-of-way through former TERRESTRIAL-PRAIRIE. Probably once modal in TERRESTRIAL-PRAIRIE where it is now extinct. According to R. Pleznac, this species once persisted with *Baptisia lactea* in pastures on Grand Prairie much as it once did on Prairie Ronde and Gourdneck Prairie. Only one extant site is now known. This is in remnant oak savanna in Fort Custer, and was discovered by P. J. Higman (MNFI). In recent years, populations have disappeared even from protected sites such as the Hampton Creek Consumers Power right-of-way, probably due to fire suppression, herbicide application, and potentially, lack of pollination and subsequent seed production. Like many other of our formerly common and characteristic TERRESTRIAL-PRAIRIE and oak savanna plants, this species is nearly extinct in Kalamazoo County.

***Vincetoxicum nigrum* (L.) Moench**

First collected by H. R. Becker on his farm in Charleston Tp. on 21 October 1950, climbing a shaded fence. Now widespread and occasional in the E½ of the county, especially along roadsides, RR rights-of-way, and in other disturbed open situations, climbing into hedges, fences, small trees, and shrubs. Locally established and spreading. Not in Hanes & Hanes (1947).

CONVOLVULACEAE

Morning-glory Family

Calystegia hederacea* Wall. Hanes: *Convolvulus japonicus

California-rose; Japanese Bindweed

Current status unknown. First collected by the Haneses in 1936. Not native.

Calystegia sepium* (L.) R. Br. Hanes: *Convolvulus sepium

Hedge Bindweed

Occasional. FEN, OAK-HARDWOOD-FOREST, fields, and roadsides.

Calystegia spithamea* (L.) Pursh Hanes: *Convolvulus spithameus

Low Bindweed

Occasional? Primarily in the W½ of the county in sandy soil.

***Convolvulus arvensis* L.**

Field Bindweed

Common. Fields, roadsides, RR rights-of-way, and other disturbed situations. Widely established.

***Ipomoea hederacea* Jacq.**

Ivyleaf Morning-glory

Current status unknown. Collected by the Haneses 22 September 1936 from "fencerow of Perrin's garden." Not native. Not in Hanes & Hanes (1947).

Ipomoea pandurata* (L.) G. Meyer Hanes: *Ipomoea pandurata

Wild Sweet-potato; Man-of-the-earth

Current status uncertain, very rare if still extant. Collected by the Haneses from woods and roadsides in sections 4, 5, and 9 of Oshtemo Tp. A single plant was found in September 2002 growing over small *Quercus prinoides* and *Q. velutina* in rich secondary WHITE-OAK-SAVANNA/OAK-BARREN in Texas Tp. very near the former right-of-way of the Michigan Central RR. By the time this flora is published the site will be destroyed by a large residential development. No other plants are known to persist in the county despite repeated searches for them. Most former sites were once relatively open and species rich former OAK-BARREN, but have now developed into closed-canopy OAK-HARDWOOD-FOREST, or have been destroyed by development or other significant disturbance. Collected by F. W. Rapp on 2 August 1946 from the vicinity of Sunset Lake in Vicksburg.

Ipomoea purpurea* (L.) Roth Hanes: *Ipomoea purpurea

Common Morning-glory

Current status unknown. Collected by the Haneses from near "dwellings" and "dumps." Not since known outside of cultivation. Not native.

CUSCUTACEAE**Dodder Family*****Cuscuta campestris* Yuncker**

Field Dodder

Current status uncertain, very rare if still extant. Collected by the Haneses from the "border of a swamp NE of Goose Lake." Here its hosts included *Bidens* and *Impatiens*. Last observed in 1937.

***Cuscuta cephalanthi* Engelm.**

Buttonbush Dodder

Current status uncertain, very rare if still extant. Collected by the Haneses at "Spring Brook" and from near the SW shore of Indian Lake where it grew on *Salix*, *Spiraea*, and *Solidago*.

***Cuscuta coryli* Engelm.**

Hazel Dodder

Current status uncertain, very rare if still extant. Collected by the Haneses from Eagle Lake growing on *Aster*, *Solidago*, and *Stachys hyssopifolia*. Also collected by the Haneses from one mi. E of Sugarloaf Lake growing on *Amphicarpaea*, *Aster*, and *Ceanothus*. Still occurred on the NW shore of Eagle Lake (1997) in COASTAL-PLAIN-MARSH. In 2002, the COASTAL-PLAIN-MARSH at this site was in bad shape (much purple loosestrife) and no plants were found, perhaps due to recent water level stabilization.

***Cuscuta gronovii* Schultes**

Common or Swamp Dodder

Common. FEN, BOG, and alongside many kinds of wetlands growing on a diversity of hosts, including, but not limited to, *Cephalanthus*, *Cornus*, *Decodon*, *Impatiens*, *Laportea*, *Polygonum*, and *Salix*.

***Cuscuta pentagona* Engelm.**

Field Dodder

Current status uncertain, very rare if still extant. Collected by the Haneses growing on *Agrostis*, *Euphorbia*, and *Rubus* N of Sugarloaf Lake in a sandy old field, and in Camp Custer on *Ceanothus* and *Euphorbia*. Last observed in 1945.

***Cuscuta polygonorum* Engelm.**

Smartweed Dodder

Current status uncertain, very rare if still extant. Collected by the Haneses from *Cephalanthus* near Weeds Lake. Last observed in 1941.

POLEMONIACEAE**Phlox Family*****Phlox bifida* L. C. Beck**

Sand Phlox

Current status uncertain, very rare if still extant. Collected by the Haneses from a RR right-of-way on Prairie Ronde, 1–1.25 mi. S of Schoolcraft (Hanes 1938). Many other interesting and rare prairie plants persist in this area. Last collected by H. E. Ballard and R. W. Pippen on 31 April 1981 (MSC). This area has since been partly bulldozed and the plants have not been relocated. However, the plants do not always flower, and may easily be overlooked (R. W. Pippen pers. comm.). I have not located any plants despite more than a dozen visits to the area between 1996 and 2002.

***Phlox divaricata* L.**

Wild Blue Phlox

Occasional. SUGAR-MAPLE-FOREST.

***Phlox paniculata* L.**

Perennial or Garden Phlox

Occasional. Roadsides, and old homesites where it may merely persist from past cultivation. Not native.

***Phlox pilosa* L.**

Prairie Phlox

Probably once abundant in TERRESTRIAL-PRAIRIE on Prairie Ronde and elsewhere in prairie and oak savanna (see the account of Prairie Ronde by Brown 1881, as cited in Chapman 1984 in the section on *Terrestrial Prairie*, Appendix III). Now occasional in oak savanna and FEN.

***Phlox subulata* L.**

Moss-pink; Moss Phlox

A rare escape from cultivation. Known today only from a cemetery and a roadside, both in the SE¼ of the county.

HYDROPHYLLACEAE**Waterleaf Family*****Hydrophyllum appendiculatum* Michaux**

Great Waterleaf

Common. SUGAR-MAPLE-FOREST and HARDWOOD-SWAMP.

***Hydrophyllum canadense* L.**

Broadleaved or Canada Waterleaf

Occasional. SUGAR-MAPLE-FOREST. Not as frequent as *H. appendiculatum*.***Hydrophyllum virginianum* L.**

Virginia Waterleaf

Occasional. SUGAR-MAPLE-FOREST, primarily in the SE¼ of the county.

BORAGINACEAE**Borage Family*****Cynoglossum officinale* L.**

Hound's-tongue

Rare. Usually in relatively dry soil at forest edges, and in old fields.

***Echium vulgare* L.**

Viper's Bugloss; Blueweed

Rare. Roadsides and RR rights-of-way. Not native.

***Hackelia virginiana* (L.) I. M. Johnston**

Johnston Beggar's-lice

Occasional. Most forested terrestrial situations. Often especially abundant in SUGAR-MAPLE-FOREST.

Lappula squarrosa* (Retz.) Dumort. Hanes; *L. echinata

Stickseed

Current status uncertain. Roadsides and RR rights-of-way. Not native.

***Lithospermum arvense* L.**

Corn Gromwell

Occasional. RR rights-of-way, roadsides, and old fields. Not native.

***Lithospermum canescens* (Michaux) Lehm.**

Hoary Puccoon

Very rare. Collected by the Haneses from oak savanna and TERRESTRIAL-PRAIRIE, primarily in the W½ of the county. Now lacking from most former sites. Nearly extinct.

Lithospermum caroliniense (J. F. Gmelin) MacMillan **Hanes:** *L. croceum*

Hairy or Yellow Puccoon

Rare. Collected by the Haneses from sandy oak savanna, old fields, and other open dry sandy habitats. Now rare in similar situations, and lacking from many former sites. Planted in a BLACK-OAK-BARREN reconstruction immediately S of the commuter lot SE of the intersection of Centre St. and US 131, Kalamazoo.

Myosotis arvensis (L.) Hill

Occasional. Known from open to lightly shaded disturbed situations. Not native. Not in Hanes & Hanes (1947).

Myosotis scorpioides L.

Forget-me-not

Occasional. Disturbed wet situations including along lakeshores, streams, and the Kalamazoo River. Not native.

Myosotis stricta Roemer & Schultes **Hanes:** *M. micrantha*

Current status unknown. Collected by the Haneses from the "Vicksburg cemetery S of the highway." Not native.

Myosotis verna Nutt.

White Forget-me-not

The few plants I have seen grew in shady situations in relatively dry sandy soil near lakeshores.

Plagiobothrys hirtus (Greene) I. M. Johnston

Popcorn-flower

Current status unknown. Collected by the Haneses from "a moist meadow one mi. W of the grain elevator at Schoolcraft" in 1938 and 1939 (Voss 1996; Hanes 1940, Hanes & Hanes 1947). Not native.

VERBENACEAE

Vervain Family

Phryma leptostachya L.

Lopseed

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST. Included in the Haneses' (1947) PHYRMACEAE.

Phyla lanceolata (Michaux) Greene **Hanes:** *Lippia lanceolata*

Fog-fruit

Current status uncertain. Collected by the Haneses from two sites near the Kalamazoo River, and a third site (only one plant) "on the E shore of Austin Lake."

Verbena bracteata Lag. & Rodr.

Prostrate or Creeping Vervain

Occasional. Relatively open, rich, disturbed ground. Not native.

Verbena hastata L.

Blue Vervain

Occasional. FEN, WET-MEADOW, SHRUB-CARR, and WET-PRAIRIE.

The hybrid *Verbena × engelmannii* (*V. hastata* × *V. urticifolia*) is rare throughout where both parents co-occur.

Verbena stricta Vent.

Hoary Vervain

Occasional. Old fields, roadsides, and RR rights-of-way. Usually in dry sandy soil. Not native.

Verbena urticifolia L.

White Vervain

Occasional. Forest edges with wetlands. Known to hybridize with *V. hastata* forming the named hybrid *Verbena × engelmannii* (see *V. hastata*).

LABIATAE (LAMIACEAE)**Mint Family**

Acinos arvensis (Lam.) Dandy

Mother-of-thyme; Basil-thyme

Current status unknown. Collected by the first botanical survey. Not native. Not in Hanes & Hanes (1947).

Agastache nepetoides (L.) Kuntze

Giant Hyssop

Occasional? SUGAR-MAPLE-FOREST, OAK-HARDWOOD-FOREST (probably at least in part as a relict from former WHITE-OAK-SAVANNA), and nearby old fields and fencerows.

Agastache scrophulariifolia (Willd.) Kuntze **Hanes:** *A. scrophulariaefolia*

Figwort Giant Hyssop

Collected by the Haneses from "fencerows and fields" essentially throughout. Probably once occurred in all but the driest oak savannas.

Ajuga reptans L.

Rare. Lawns and roadsides. Not native.

Blephilia ciliata (L.) Bentham

Downy Blephilia

Rare. Dry sandy BLACK-OAK-BARREN in the W½ of the county.

Blephilia hirsuta (Pursh) Bentham

Wood Mint

Occasional. Relatively wet SUGAR-MAPLE-FOREST.

Clinopodium vulgare L. **Hanes:** *Satureja vulgaris*

Wild-basil; Dog-mint

Current status uncertain. Collected by the Haneses from "oak woods" and "roadsides." Collected in 1994 by P. J. Higman and S. Grund in the NE¼ of the county, but not otherwise recently known. Not native.

Collinsonia canadensis L.

Stoneroot; Horse-balm

Occasional. SUGAR-MAPLE-FOREST.

Dracocephalum parviflorum Nutt.

Dragonhead

Collected by the Haneses on 13 June 1937 in alfalfa on the H. R. Becker farm (Charleston Tp.). Adventive.

Glechoma hederacea L. **Hanes:** *Glechoma hederacea*

Ground-ivy; Gill-over-the-ground; Creeping Charlie

Occasional. Moist to wet situations including disturbed swamp forests, roadsides, and old fields. Widely established.

Hedeoma hispida Pursh

Rough Pennyroyal

Rare. Dry, sandy soil in old fields and along roadsides, primarily in the W½ of the county.

Hedeoma pulegioides (L.) Pers.

American Pennyroyal

Current status unknown. Collected by the Haneses from "oak woods" essentially throughout.

Hyssopus officinalis L.

Hyssop

Current status unknown. An early collection (probably made by the first botanical survey) is known from a Kalamazoo roadside (GH). Reported by Elliott (1960) as an "infrequent member of old field

succession" in Ross Tp. (but I am not aware of a supporting specimen). No Michigan specimens have been seen since 1918 (Voss 1996). Not in Hanes & Hanes (1947). Not native.

***Lamium amplexicaule* L.**

Henbit

Occasional. Old fields and waste places. Not native.

***Lamium maculatum* L.**

Probably a rare escape from cultivation in waste places throughout. Not in Hanes & Hanes (1947).

***Lamium purpureum* L.**

Purple Dead Nettle

Occasional. Gardens, lawns, and other disturbed situations. Locally common on the WMU campus (1996). Not native.

***Leonurus cardiaca* L.**

Motherwort

Common. Lawns and waste places. Not native.

***Lycopus americanus* W. P. C. Barton**

American Water Horehound

Occasional. Often in marly wetlands. Usually in lightly shaded situations in FEN, WET-MEADOW, and SHRUB-SWAMP.

***Lycopus rubellus* Moench**

Water Horehound

Current status unknown. Collected by the Haneses from "wooded swamps" essentially throughout.

***Lycopus uniflorus* Michaux**

Bugleweed

Occasional. COASTAL-PLAIN-MARSH and sandy WET-MEADOW, primarily in the W½ of the county.

***Lycopus virginicus* L.**

Bugleweed

Current status uncertain. Collected by the Haneses from "peaty woods" N of Vicksburg, and from Schoolcraft and Texas Tps. Reportedly "infrequent" in "marsh" near the Kalamazoo River at the Augusta Floodplain Forest Preserve (Meagher & Tonsor 1992).

***Marrubium vulgare* L.**

Horehound

Probably an occasional escape from cultivation throughout the county.

***Melissa officinalis* L.**

Lemon-balm

Current status unknown. Collected by the Haneses from roadsides and the edge of a "cathole." Collected by F. W. Rapp from his woods. Not native.

***Mentha arvensis* L.**

Wild Mint

Occasional? Disturbed lakeshores. Not native.

The hybrid *Mentha* × *cardiaca* (*M. arvensis* × *M. spicata*) has been collected in Kalamazoo County (Voss 1996).

***Mentha spicata* L.**

Spearmint

Rare. Roadsides. Not native. Known to hybridize with *M. arvensis* forming the named hybrid *Mentha* × *cardiaca* (see *M. arvensis*).

Mentha suaveolens* Ehrh. Hanes: *M. rotundifolia

Apple or Pineapple Mint

Current status unknown. Collected by F. W. Rapp and the Haneses from several locations in the S½ of the county between 1935 and 1941. Not native.

Mentha ×piperita* L. Hanes: *M. piperita

Peppermint

Current status uncertain. Disturbed swamp forest and other disturbed situations, especially near roadsides. Not native.

***Monarda didyma* L.**

Oswego-tea; Bee-balm

Collected by the Haneses on 13 July 1953 from a Schoolcraft roadside. Not likely native. Not in Hanes & Hanes (1947).

***Monarda fistulosa* L.**

Wild-bermagot

Common. Old fields, FEN, WET-PRAIRIE, TERRESTRIAL-PRAIRIE, and mesic oak savanna. This showy species has relatively wide ecological amplitude.

***Monarda punctata* L.**

Dotted or Horse Mint

Occasional. Sandy old fields and BLACK-OAK-BARREN.

***Nepeta cataria* L.**

Catnip; Catmint

Occasional. Forest edges and old homesites. Locally established, not native.

Physostegia virginiana* (L.) Benth Hanes: *P. speciosa

False Dragonhead; Obedient Plant

Current status uncertain, very rare if still extant. Collected by the Haneses from several locations on the floodplain of the Kalamazoo River including E and W of Comstock, E of Galesburg, and in section 4 of Cooper Tp. Probably native.

***Prunella vulgaris* L.**

Self-heal; Heal-all

Occasional. Lawns and other open disturbed situations. Both native and introduced plants probably occur here (Voss 1996).

Pycnanthemum tenuifolium* Schrader Hanes: *P. flexuosum

Narrow-leaved Mountain Mint

Extinct. Known only from a 1933 Hanes collection made from a fencerow on Prairie Ronde (former TERRESTRIAL-PRAIRIE) between sections 12 and 13 of Prairie Ronde Tp. Noted by the Haneses to be absent the following year. Not again observed or collected in Kalamazoo County.

***Pycnanthemum virginianum* (L.) B. L. Rob. & Fernald**

Mountain Mint

Occasional. FEN, WET-PRAIRIE, TERRESTRIAL-PRAIRIE, and WET-MEADOW.

***Salvia azurea* Lam.**

Blue Sage

Current status unknown. Collected by the Haneses from a RR right-of-way N of Vicksburg near the Prudential Nursery. Not native.

***Salvia reflexa* Hornem.**

Rocky Mountain Sage

Collected by the Haneses from "3 mi. SE of Schoolcraft in a field" (Schoolcraft Tp.) where it was "rare" (Hanes & Hanes 1947; Hermann 1936). Adventive.

Satureja hortensis L. Hanes: *S. vulgaris*

Summer Savory

Rare. OAK-HARDWOOD-FOREST. Not native.

Scutellaria elliptica Sprengel

Hairy Skullcap

Current status uncertain. Collected by the Haneses from WHITE-OAK-SAVANNA, BLACK-OAK-BARREN, and open hillsides in OAK-HARDWOOD-FOREST.

Scutellaria galericulata L. Hanes: *S. epilobifolia*

Marsh Skullcap

Occasional. On pond, river, and lake borders in WET-MEADOW, FEN, and EM-MARSH.

Scutellaria lateriflora L.

Mad-dog Skullcap

Occasional. Open WET-MEADOW, FEN, rich HARDWOOD-SWAMP, and in other swampy situations.

Stachys hyssopifolia Michaux

Hedge Nettle

Occasional. Moist sandy situations, especially COASTAL-PLAIN-MARSH, and mostly limited to the W½ of the county.

Stachys palustris L.

Collected by the Haneses from SE of Austin Lake in sandy EM-MARSH/COASTAL-PLAIN-MARSH.

Stachys tenuifolia Willd.

Smooth Hedge Nettle

Collected by the Haneses from near the Kalamazoo River, and from Brady Tp. in "moist" ground. Reportedly "infrequent" in a "wet thicker" under a dense canopy of shrubs along the Kalamazoo River at the Augusta Floodplain Forest Preserve (Meagher & Tonsor 1992).

Teucrium canadense L.

Wood-sage

Known from EMERGENT-MARSH near the Kalamazoo River, a disturbed roadside through SUGAR-MAPLE-FOREST in the NE¼ of the county, and from the vicinity of large wetlands in Prairie Ronde Tp. Includes the Haneses' (1947) *T. occidentale*.*Trichostema dichotomum* L.

Bastard-pennyroyal

Extinct. Collected by the Haneses from "a sterile sandy field on the border of an oak wood in Section 7 Oshtemo Tp." (Hanes 1941). Last seen in 1951 in a sandy BLACK-OAK-BARREN NW of the intersection of 2nd St. and S Ave.**SOLANACEAE****Nightshade Family***Datura stramonium* L.

Jimsonweed

Occasional. Hog yards, pastures, and waste places. Not native.

Lycium chinense Miller

Current status unknown. Collected by the Haneses from roadsides in the S½ of the county. Not native.

Lycopersicon esculentum Miller

Tomato

A rare escape from recent cultivation throughout the county. Usually at or near sites where garden waste is dumped. Not in Hanes & Hanes (1947). Not native.

***Petunia xatkinsiana* Loudon**

Petunia

Rare. Roadsides and old fields. Usually at or near sites where garden waste is dumped. Not in Hanes & Hanes (1947). First collected by the Haneses "near Schoolcraft Park" on "roadsides" 14 July 1936. Not native.

Physalis alkekengi* L. Hanes: *P. ambigua

Chinese-lantern-plant

Current status unknown. Collected by the Haneses from roadsides, fields, and orchards. Not native.

***Physalis heterophylla* Nees**

Occasional. Old fields, roadsides, and occasionally RR rights-of-way.

Physalis longifolia* Nutt. Hanes: *P. subglabrata

Smooth Ground Cherry

Occasional? Open grassy situations including old fields and especially RR rights-of-way.

***Physalis virginiana* Miller**

Virginia Ground Cherry

Rare. Relatively intact BLACK-OAK-BARREN, WHITE-OAK-SAVANNA, RR rights-of-way, and on hillsides, primarily in the W½ of the county.

***Solanum carolinense* L.**

Horse-nettle

Occasional. Old fields, pastures, fencerows, and roadsides. Not native.

***Solanum dulcamara* L.**

Nightshade; Bittersweet

Common in a diversity of more or less disturbed situations. Not native.

***Solanum physalifolium* Rusby**

Hairy or Argentinian Nightshade

A recent introduction, probably still rare (but apparently spreading) in disturbed ground throughout the county. First collected by T. Trana 21 September 1993 (MICH). Not native. Not in Hanes & Hanes (1947).

Solanum pychanthum* Dunal Hanes: *S. nigrum

Black Nightshade

Occasional. Recently disturbed situations along roadsides, at construction sites, etc. Not native.

***Solanum rostratum* Dunal**

Buffalo-Bur

Collected a few times by the Haneses, but apparently then infrequent. Now occasional in old fields and other grassy disturbed situations. Not native.

***Solanum tuberosum* L.**

Potato

Occasional. Waste places. May persist at the site of old gardens or where dumped. First collected by F. W. Rapp on 1 August 1946. Not native. Not in Hanes & Hanes (1947).

SCROPHULARIACEAE**Snapdragon Family**

Several species of *Veronica* are reported here based solely on annotations made to specimens in the Hanes herbarium by E. G. Voss and included in his treatment of this genus for Volume III of Michigan Flora (1996).

Agalinis gattereri* (Small) Small Hanes: *Gerardia gattereriGatteringer's *Gerardia*

Extinct. Collected by the Haneses in 1935 SE of Sugarloaf Lake at the edge of a small sandy rise of

former oak savanna in what was otherwise species rich WET-PRAIRIE. The immediate site was probably sandy wet or wet-mesic prairie. The entire site including most of the surrounding WET-PRAIRIE has been heavily grazed and the rich assemblage of rare prairie and savanna plants that the Haneses collected here has mostly disappeared.

Agalinis paupercula (A. Gray) Britton **Hanes:** *Gerardia paupercula*

Occasional. At the margins of lakes and streams.

Agalinis purpurea (L.) Pennell **Hanes:** *Gerardia purpurea*

Purple *Gerardia*

Occasional. On sandy lakeshores and in COASTAL-PLAIN-MARSH.

Agalinis tenuifolia (Vahl) Raf. **Hanes:** *Gerardia tenuifolia*

Current status uncertain, very rare if still extant. Collected only by the Haneses from "an open oak woodland on the E side of Stony L."

Aureolaria flava (L.) Farw.

Smooth False Foxglove

Occasional. WHITE-OAK-SAVANNA and BLACK-OAK-BARREN, usually associated with White Oak. This perennial is known to hybridize with *A. pedicularia* in Kalamazoo County (Voss 1996; Ballard & Pippen 1991). Hybrids still occur at the interface between sandy oak savanna and OAK-HARDWOOD-FOREST at the Hampton Creek Consumers Power right-of-way (Gourdneck State Game Area).

Aureolaria pedicularia (L.) Raf. **Hanes:** *A. pedicularis*

Clammy False Foxglove

Occasional. Usually associated with Black Oak in relatively open OAK-HARDWOOD-FOREST, BLACK-OAK-BARREN, and at the edges of overgrown WHITE-OAK-SAVANNA.

Aureolaria virginica (L.) Pennell

Downy False Foxglove

Occasional. Often at the edges of OAK-HARDWOOD-FOREST, and overgrown WHITE-OAK-SAVANNA and BLACK-OAK-BARREN.

Besseyia bullii (Eaton) Rydb.

Kitten-tail

Very rare. Collected by the Haneses from hillside prairie at Eagle Lake, West Lake, McGinnis Lake, and Crooked Lake. Also collected by the Haneses from relatively species rich BLACK-OAK-BARREN near the aforementioned hillside prairie at Crooked Lake. Collected 20 May 1932 by Lela Kelly "near hospital farm" in "open places." Also collected from along the W fork of Portage Creek in section 5 of Portage Tp., in dry hillside oak forest (probably former hillside prairie). In 1999 I found a few sterile plants growing in overgrown hillside prairie at Crooked Lake, but from 1996–2002 in searches that encompassed all but two known former sites, and several potential sites for hillside prairie, no other plants were located (though these searches should not be considered exhaustive). In fact, vanishingly little hillside prairie was found. Most sites had succeeded to closed-canopy OAK-HARDWOOD-FOREST or were occupied by homes. It is possible that I overlooked plants, but clearly this Midwestern endemic is nearly extinct in Kalamazoo County. Development of hillside prairies, canopy closure, and shrub encroachment are apparently significant factors accounting for its present rarity. It is possible that in the past, hillsides where this plant grew were kept open by severe drought and less so by fire, although today, drought alone does not seem sufficient to retard forest formation on even the driest formerly somewhat open hillsides. Probably once an occasional component of dry oak savanna.

Buchnera americana L.

Blue-hearts

Extinct. Collected by the first botanical survey 28–31 August 1837. Also collected by the first botanical survey 23 July 1838. An additional unlabeled sheet at WMU is probably a first botanical survey

collection. The habitat and location of all known collections are unknown, but this plant was probably a component of the former savanna flora. Not in Hanes & Hanes (1947).

***Castilleja coccinea* (L.) Sprengel**

Indian Paintbrush

Castilleja coccinea f. *lutescens* (called f. *pallens* by the Haneses) has a bright yellow calyx and bracts, rather than red. Forma *lutescens* is rare in FEN, WET-MEADOW, and sandy wet-mesic to WET-PRAIRIE. The red-flowered form is even less common, and was last collected by the Haneses from "marshy meadows" in section 18 of Richland Tp. and section 6 of Oshtemo Tp. It is otherwise known only from a Hanes collection from WET-PRAIRIE near Sugarloaf Lake (now heavily grazed). I have not located any plants at this former site despite half a dozen visits. Current status of the red flowered form is uncertain, but it is clearly very rare, if still extant.

***Chaenorrhinum minus* (L.) Lange**

Dwarf-snapdragon

Occasional in ballast along RR rights-of-way.

***Chelone glabra* L.**

Turtlehead

Occasional. FEN, WET-MEADOW, SHRUB-CARR, and WET-PRAIRIE.

***Collinsia verna* Nutt.**

Blue-eyed-Mary

Rare. Rich SUGAR-MAPLE-FOREST. A winter annual. No longer occurs at several former sites including the "Island" woods in Schoolcraft.

***Gratiola neglecta* Torrey**

Clammy Hedge-hyssop

Current status uncertain. Collected by the Haneses from an "old muddy creek bed" in section 31 of Wakeshma Tp. (Hanes 1941).

***Linaria canadensis* (L.) Dum. Cours.**

Blue Toadflax

Occasional. Sandy soil of BLACK-OAK-BARREN and open sandy OAK-HARDWOOD-FOREST.

***Linaria dalmatica* (L.) Miller**

Dalmatian Toadflax

Current status unknown. First collected from along a roadside in 1962. Not in Hanes & Hanes (1947). Not native.

***Linaria vulgaris* Miller**

Butter-and-eggs

Occasional. Roadsides and RR rights-of-way.

Lindernia dubia* (L.) Pennell Hanes: *L. anagallidea

False Pimpernel

Current status uncertain. EM-MARSH. Some authors recognize *L. dubia* var. *anagallidea* as a distinct species. However, intermediates with characters similar to both the species and variety have been found in Kalamazoo County. Purported "*anagallidea*" (regardless of the rank, if any, at which it is recognized), has only been reported by the Haneses from a pond just E of Gourdneck Lake between the years 1936 and 1942. The plants grew in mud, had many branches, and produced many flowers. When visited in later years with more water, the plants were under water and produced few flowers. These submerged plants had erect stems, unlike the plants seen in previous relatively dry years (Hanes 1938).

***Melampyrum lineare* Desr.**

Cow-wheat

Occasional. Sandy OAK-HARDWOOD-FOREST.

Mimulus glabratus Kunth

Yellow Monkey Flower

Current status uncertain. EM-MARSH along lakeshores and streams, and in wet, springy areas in FEN and WET-MEADOW.

Mimulus ringens L.

Square-stemmed Monkey Flower

Occasional. EM-MARSH along lakeshores, in COASTAL-PLAIN-MARSH, WET-MEADOW, FEN, and WET-PRAIRIE.

Pedicularis canadensis L.

Early Wood Betony

Occasional. Often at sandy OAK-HARDWOOD-FOREST edges in former WHITE-OAK-SAVANNA and BLACK-OAK-BARREN. Probably once also a component of TERRESTRIAL-PRAIRIE.

Pedicularis lanceolata Michaux

Swamp Wood Betony

Occasional. Moist to wet, usually forested situations.

Penstemon digitalis Sims

Foxglove Beard-tongue

Rare. Moist to wet, usually sandy old fields.

Penstemon hirsutus (L.) Willd.

Hairy Beard-tongue

Extinct. Collected by the Haneses from RR rights-of-way and other marginal habitats in areas of sandy former WHITE-OAK-SAVANNA.

Penstemon pallidus Small

Small Pale Beardtongue

Extinct. Collected by the Haneses from "sandy moist or dry soil" along a roadside through WHITE-OAK-SAVANNA and from a RR right-of-way on Prairie Ronde in TERRESTRIAL-PRAIRIE. Not since collected.

Scrophularia lanceolata Pursh

Rare to occasional throughout on Prairie Ronde, Gourdneck Prairie, and elsewhere primarily in the SW¼ of the county in fencerows and along roadsides. May have once been a component of TERRESTRIAL-PRAIRIE.

Scrophularia marilandica L.

Figwort

Occasional. SUGAR-MAPLE-FOREST.

Verbascum blattaria L.

Moth Mullein

Occasional. Roadsides, RR rights-of-way, old fields, and other waste places. Widely established.

Verbascum phlomoides L.

Occasional. First collected in Michigan in 1941 by the Haneses from a roadside 1.5 mi. W of Schoolcraft (Hanes 1943). Not native.

Verbascum thapsus L.

Mullein; Flannel Plant

Common. A diversity of disturbed open situations. Widely established.

Veronica anagallis-aquatica* L. Hanes: *V. connata* & *V. salina

Water Speedwell

Occasional? Streams and ditches. Both native and introduced plants occur in Kalamazoo County.

***Veronica arvensis* L.**

Field Speedwell

Occasional. Fields, pastures, and quite generally in disturbed situations throughout. Not native.

Veronica austriaca* L. Hanes: *V. teucrium

Current status unknown. First collected 14 June 1935. All collections are from near old homesteads and roadsides. Not native. Not in Hanes & Hanes (1947).

Veronica beccabunga* L. Hanes: *V. americana

Brooklime

Current status unknown. Collected by the Haneses from the border of Allen Creek in section 25 of Kalamazoo Tp. Both native and introduced plants occur here.

Veronica chamaedrys* L. Hanes: probably *V. teucrium

Germander Speedwell

Current status unknown. Collected by the Haneses from roadsides and lawns. Also reported by Elliott (1960). Not native.

***Veronica filiformis* Sm.**

Creeping Speedwell

Current status unknown. First collected in Michigan from Kalamazoo and Washtenaw Counties in 1978. Not in Hanes & Hanes (1947). Not native.

***Veronica officinalis* L.**

Common Speedwell

Occasional? Wet disturbed forests and waste places. Not native.

***Veronica peregrina* L.**

Purslane Speedwell

Occasional. Lawns, fields, and disturbed lakeshores.

***Veronica persica* Poir.**

Bird's-eye Speedwell

Occasional. Lawns. Not native.

***Veronica polita* Fries**

Current status unknown. First collected in 1937 from a lawn in Schoolcraft. Not native. Not in Hanes & Hanes (1947).

***Veronica scutellata* L.**

Marsh Speedwell

Occasional? Ditches and lakeshores.

***Veronica serpyllifolia* L.**

Thyme-leaved Speedwell

Common. Lawns. Not native.

***Veronicastrum virginicum* (L.) Farw.**

Culver's-root

Occasional. RR rights-of-way and roadsides, TERRESTRIAL-PRAIRIE, WET-PRAIRIE, FEN, WHITE-OAK-SAVANNA, BUR-OAK-SAVANNA, and mesic to wet-mesic situations in BLACK-OAK-BARREN. Essentially a prairie and oak savanna plant with wide ecological amplitude.

BIGNONIACEAE**Bignonia or Trumpet-creeper Family**

Campsis radicans (L.) Bureau

Trumpet-creeper; Trumpet-flower

Rare. Former homesites, and old fields. Not native.

Catalpa bignonioides Walter

Common Catalpa

A May 1934 roadside collection from near Barton Lake is probably this species (Voss 1996). Probably not native.

Catalpa speciosa (Warder) Engelm.

Catalpa; Cigar-tree

A widespread and occasional escape from cultivation along roadsides, in old fields, and in degraded OAK-HARDWOOD-FOREST and BLACK-OAK-BARREN. Locally established.

OROBANCHACEAE**Broom-rape Family**

Conopholis americana (L.) Wallr.

Squaw-root

Occasional. OAK-HARDWOOD-FOREST.

Epifagus virginiana (L.) W. P. C. Barton

Beech-drops

Occasional. SUGAR-MAPLE-FOREST with *Fagus grandifolia*.

Orobanche uniflora L.

One-flowered Broomrape

Current status uncertain, very rare if still extant. Collected by the Haneses from an "oak and pine wood" near "Deep Point," Long Lake, and collected by H. R. Becker from woods in section 30 of Charleston Tp.

LENTIBULARIACEAE**Bladderwort Family**

Utricularia cornuta Michaux

Horned Bladderwort

Occasional. Usually in marly depressions in lakeside FEN.

Utricularia gibba L.

Humped Bladderwort

Occasional. BOG and relatively acid lakeshore substrates including peaty sand and muck.

Utricularia intermedia Hayne

Flat-leaved Bladderwort

Occasional. FEN and BOG.

Utricularia minor L.

Lesser Bladderwort

Current status unknown. Collected by the Haneses from the muddy border of Whites Lake, and from marly, excavated depressions alongside Lyons Lake.

Utricularia purpurea Walter

Purple Bladderwort

Occasional. Sandy lakeshores including COASTAL-PLAIN-MARSH, primarily in the W½ of the county.

Utricularia resupinata Bigelow

Reversed Bladderwort

Occasional in COASTAL-PLAIN-MARSH in the W½ of the county.

Utricularia vulgaris L.
Common Bladderwort
Common. EM-MARSH.

PLANTAGINACEAE

Plantain Family

Plantago arenaria Waldst. & Kit. **Hanes:** *P. indica*
Psyllium

Current status unknown. Collected by the Haneses from "E of the Kalamazoo River near Roadside Park" (Hanes 1938). Not native.

Plantago aristata Michaux
Bracted Plantain

Occasional. Dry disturbed open situations. Not native.

Plantago lanceolata L.

Ribgrass; Buckhorn; Narrow-leaved or English Plantain

Occasional. Old fields, roadsides, and other open disturbed situations. Not native.

Plantago major L.

Common Plantain

Occasional. Moist roadsides, lawns, and other disturbed situations. Not native.

Plantago patagonica Jacq. **Hanes:** *P. purshii*

Current status uncertain. Sandy, dry, disturbed situations such as roadsides and old fields. Adventive.

Plantago rugelii Decne.

Rugel's Plantain

Common. Gardens, old fields, and lawns. May not be native (Voss 1996).

Plantago virginica L.

Dwarf Plantain

Current status unknown. Collected by the Haneses from roadsides and other disturbed situations. Not native.

RUBIACEAE

Madder Family

Several species of *Galium* are reported here based only upon annotations made by E. G. Voss and mapped in Volume III of Michigan Flora (1996).

A specimen of *Houstonia caerulea* L., (Bluets) is in the A. C. Roberts collection (KVM), but bears no label data. Since I cannot be sure that it was collected outside of cultivation in Kalamazoo County, I have not included it in the list below.

Cephalanthus occidentalis L.

Buttonbush

Common. SHRUB-SWAMP and other shrubby wetlands, often near lakeshores. An important component of the "shrub-zone" in COASTAL-PLAIN-MARSH.

Galium aparine L.

Goosegrass; Cleavers

Common. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

Galium asprellum Michaux

Rough Bedstraw

Occasional. FEN.

Galium boreale L.

Northern Bedstraw

Occasional. RR rights-of-way, FEN, WET-PRAIRIE, oak savannas, and TERRESTRIAL-PRAIRIE.

Galium brevipes Fernald & Wiegand

Collected only by F. W. Rapp from "E of Portage Creek, 4 mi. NE of Vicksburg" on 3 August 1941. Another F. W. Rapp collection with the same date reads "4 mi. NE Vicksburg, bank of ditch." Not in Hanes & Hanes (1947). Included in the Haneses' (1947) *G. trifidum*.

Galium circaezans Michaux

Wild Licorice

Occasional. OAK-HARDWOOD-FOREST.

Galium concinnum T. & G.

Shining Bedstraw

Occasional. OAK-HARDWOOD-FOREST, and forest edges in wet areas near swamps and streams.

Galium labradoricum (Wiegand) Wiegand

Labrador Bedstraw

Occasional. Usually found in *Sphagnum* moss in the shadow of Tamarack trees in BOG.

Galium lanceolatum Torrey

Wild Licorice

Occasional? OAK-HARDWOOD-FOREST and shrubby BLACK-OAK-BARREN.

Galium obtusum Bigelow

Wild Madder

Occasional. FEN, WET-MEADOW, and EM-MARSH.

Galium palustre L.

Marsh Bedstraw

Occasional? Mostly in the E½ of the county in WET-MEADOW and FLOODPLAIN-FOREST near the Kalamazoo River.

Galium pilosum Aiton

Hairy Bedstraw

Occasional? Sandy BLACK-OAK-BARREN and OAK-HARDWOOD-FOREST.

Galium tinctorium L.

Occasional. Mostly limited to the S½ of the county at forest edges with EM-MARSH, WET-MEADOW, and FEN.

Galium trifidum L.

Small Bedstraw

Occasional at stream margins throughout.

Galium triflorum Michaux

Sweet-scented Bedstraw

Occasional in a diversity of moist to wet forests.

Houstonia canadensis Roemer & Schultes

Fringed Houstonia

Extinct. Collected by the Haneses from along the W fork of Portage Crk. in Section 5 Portage Tp. in very dry oak forest on a hillside (perhaps former hillside prairie) alongside a creek. The plants were associated with *Selaginella rupestris*, *Besseyia bullii*, and other rare xerophytes.

Mitchella repens L.

Partridge-berry

Common. TAMARACK-SWAMP, RED-MAPLE-SWAMP, and ASH-SWAMP. Also occasionally found in relatively dry soil in OAK-HARDWOOD-FOREST.

***Sherardia arvensis* L.**

Field-madder

Current status unknown. First collected by L. A. Kenoyer on the WMU campus in 1933. Not native. Not in Hanes & Hanes (1947).

CAPRIFOLIACEAE**Honeysuckle Family*****Diervilla lonicera* Miller**

Bush-honeysuckle

Current status uncertain, very rare if still extant. Collected by the Haneses from several widely scattered locations in the W½ of the county. I have been unable to relocate plants at several of the former sites (primarily in open OAK-HARDWOOD-FOREST).

***Linnaea borealis* L.**

Twinflower

Current status uncertain, very rare if still extant. Once "plentiful over several acres" of TAMARACK-SWAMP/RED-MAPLE-SWAMP S of Little Sugarloaf Lake. Also known from "a few plants among tamaracks at Paw Paw Lake" (Hanes & Hanes 1947). Apparently extirpated from S of Little Sugarloaf Lake. Its absence is perhaps due to past hydrological changes associated with the construction of US 131, and/or recent clear-cutting of most of the swamp forest at the site. Not relocated at Paw Paw Lake, but may persist there in areas that remain unsearched.

***Lonicera canadensis* Marshall**

Fly Honeysuckle

Current status unknown. Known by the Haneses from TAMARACK-SWAMP near Barton Lake, and from the N boundary of section 7 of Wakeshma Tp.

***Lonicera dioica* L.**

Glaucous Honeysuckle

Occasional. FEN, WET-MEADOW, and openings in TAMARACK-SWAMP and RED-MAPLE-SWAMP. Usually near lakes or streams.

***Lonicera japonica* Thunb.**

Japanese Honeysuckle

Occasional outside of cultivation in a diversity of disturbed situations. Not native.

***Lonicera maacki* (Rupr.) Herder**

Amur Honeysuckle

Common outside of cultivation in a diversity of wooded and open situations. Becoming a serious pest in some of our forests and remnant oak savannas. Widely planted. Not native. Not in Hanes & Hanes (1947).

***Lonicera morrowii* A. Gray**

Morrow Honeysuckle

First collected outside of cultivation in Michigan in Kalamazoo County by F. W. Rapp in 1939. Now common throughout along RR rights-of-way and roadsides, and in old fields.

***Lonicera* × *bella* Zabel**

This hybrid (*L. morrowii* × *L. tatarica*) is occasional throughout the county in the same situations as our other weedy honeysuckles: roadsides, thickets, and dry-mesic terrestrial forests. Will back-cross (Voss 1996). Not native.

***Lonicera oblongifolia* (Goldie) Hooker**

Swamp Fly Honeysuckle

Current status unknown. Collected by the Haneses from section 23 of Alamo Tp. near the shore of Mud (Veley) Lake.

Lonicera sempervirens L.

Trumpet Honeysuckle

Current status unknown. Collected by the Haneses from the SW $\frac{1}{4}$ of the county. Not native.*Lonicera tatarica* L.

Tartarian Honeysuckle

Common. Young regenerating forest and the understory of OAK-HARDWOOD-FOREST. Sometimes in old fields. Widely established.

Lonicera xylosteum L.

European Fly Honeysuckle

Occasional outside of cultivation, invading old fields and degraded and disturbed dry to moist forests and thickets. Not native.

Sambucus canadensis L.

Common Elder

Occasional. Fencerows, SUGAR-MAPLE-FOREST, SHRUB-CARR, and RR rights-of-way.

Sambucus racemosa L. **Hanes:** *S. pubens*

Red-berried Elder; Red Elderberry

Occasional. Moist terrestrial forests.

Symphoricarpos albus (L.) S. F. Blake **Hanes:** *S. rivularis*

Snowberry

Current status uncertain. Roadsides through terrestrial forest, TERRESTRIAL-PRAIRIE, disturbed SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST. The introduced var. *laevigatus* and the native var. *albus* both occur here.*Symphoricarpos orbiculatus* Moench

Coralberry

Current status uncertain. RR rights-of-way and roadsides. Not native.

Triosteum aurantiacum E. P. Bicknell

Feverwort

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST.

Triosteum perfoliatum L.

Wild Coffee; Horse Gentian

Occasional. Rich OAK-HARDWOOD-FOREST. Probably once occurred in oak savanna.

Viburnum acerifolium L.

Maple-leaved Viburnum

Occasional. Rich HARDWOOD-SWAMP, RED-MAPLE-SWAMP, SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST.

Viburnum dentatum L.

Arrow-wood

Current status unknown. First reported by Elliott (1960); "common member of natural shrub border on road-cut, N of main campus, [MSU] Biological Station." The most recent report is a collection made by M. McCann on 1 June 1976 from section 30 of Kalamazoo Tp. at Little Asylum Lake "edge of marsh N of Lake, single 2 m tall bush." Not native. Not in Hanes & Hanes (1947).

Viburnum lentago L.

Nannyberry

Occasional. FEN, TAMARACK-SWAMP, RED-MAPLE-SWAMP, and WET-MEADOW. Usually near lakes and streams.

Viburnum opulus* L. Hanes: *V. trilobum

Highbush-cranberry; Guelder-rose

Occasional. FEN, WET-MEADOW, and openings in RED-MAPLE-SWAMP. Generally found in open forest and wetlands near lakes, streams, and the Kalamazoo River.

***Viburnum prunifolium* L.**

Black-haw

Rare. Collected by the Haneses from SUGAR-MAPLE-FOREST and HARDWOOD-SWAMP. Reported from the Augusta Floodplain Forest Preserve in SUGAR-MAPLE-FOREST on levees in an area otherwise dominated by FLOODPLAIN-FOREST (Meagher & Tonsor 1992). Difficult to discern from *V. lentago*.

Viburnum rafinesquianum* Schultes Hanes: *V. affine

Downy Arrow-wood

Occasional. Rich SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

VALERIANACEAE**Valerian Family*****Valeriana edulis* T. & G. Hanes: *V. ciliata***

Edible Valerian

Current status uncertain, very rare if still extant. Collected by the Haneses from FEN on the E side of Paw Paw Lake. Reported without a specimen from FEN at Butterfield Lake (MNFI EO record).

***Valeriana officinalis* L.**

Common Valerian; Garden-heliotrope

Current status unknown. Collected only by the Haneses on 13 June 1945 from a disturbed HARDWOOD-SWAMP SW of Fulton. Not native. Not in Hanes & Hanes (1947).

***Valeriana uliginosa* (T. & G.) Rydb.**

Swamp Valerian

Occasional in FEN.

Valerianella chenopodiifolia* (Pursh) DC. Hanes: *Valerianella chenopodifolia

Goosefoot Corn Salad

Current status uncertain, very rare if still extant. Collected by the Haneses from FLOODPLAIN-FOREST near the Kalamazoo River 2½ mi. E of Galesburg where it was apparently associated with *Chaerophyllum procumbens*.

DIPSACACEAE**Teasel Family*****Dipsacus fullonum* L. Hanes: *D. sylvestris***

Wild Teasel

First reported (but without a specimen) from Kalamazoo County on 26 September 1903 from pasture in Prairie Ronde Tp. (Burgess notes, see *Linum usitatissimum*). Apparently uncommon with the Haneses, but now common throughout along roadsides, in old fields, and in other open disturbed situations. Widely established.

***Dipsacus laciniatus* L.**

Cut-leaf Teasel

Current status unknown. First collected by L. West and W. H. Wagner Jr. from along EF Ave. in section 25 of Cooper Tp. on 1 August 1973. Label reads "one huge plant over 5 ft. tall growing along weedy, shaded roadside" (MICH). Not native. Not in Hanes & Hanes (1947).

CUCURBITACEAE**Gourd Family*****Echinocystis lobata* (Michaux) T. & G.**

Wild-cucumber

Common. Lakeshores, SHRUB-SWAMP, FEN, SHRUB-CARR, WET-MEADOW, and swampy forests of all kinds.

CAMPANULACEAE**Bellflower Family***Campanula americana* L.

Tall or American Bellflower

Occasional. SUGAR-MAPLE-FOREST and OAK-HARDWOOD-FOREST.

Campanula aparinoides Pursh

Marsh Bellflower

Occasional. FEN and WET-MEADOW. A calciphile, usually found near streams and lakeshores in sedge meadow, especially where marl is close to the surface. We have two vars. here; var. *aparinoides* with relatively small flowers (apparently limited to the W½ of the county), and var. *grandiflora* (the Haneses' *C. uliginosa*) with slightly larger flowers (more frequent and abundant throughout).

Campanula persicifolia L.

Willow Bellflower

Mapped by Voss (1996). Not in Hanes & Hanes (1947). Not native.

Campanula rapunculoides L.

Roving or Creeping Bellflower

Current status unknown. Roadsides and lawns. Not native.

Campanula rotundifolia L.

Bluebell; Harebell

Occasional. Hilly and open lakeside or streamside OAK-HARDWOOD-FOREST and hillside prairie.

Lobelia cardinalis L.

Red Lobelia; Cardinal Flower

Occasional. Thinly wooded HARDWOOD-SWAMP, FLOODPLAIN-FOREST, roadside ditches, and WET-MEADOW, especially near the Kalamazoo River.

Lobelia inflata L.

Indian-tobacco

Rare. Moist sandy old fields and OAK-HARDWOOD-FOREST.

Lobelia kalmii L.

Kalm's or Brook Lobelia

Common. FEN, WET-MEADOW, and other alkaline (often marly) lakeshores.

Lobelia siphilitica L.

Great Blue Lobelia

Occasional. FEN, WET-MEADOW, COASTAL-PLAIN-MARSH, WET-PRAIRIE, and other open and sandy moist to wet situations.

Lobelia spicata Lam.

Pale Spiked Lobelia

Rare. Moist situations alongside streams and other wetlands, usually in sandy soil.

Triodanis perfoliata (L.) Nieuwl. **Hanes:** *Specularia perfoliata*

Venus' Looking-glass

Rare. Oak savanna and TERRESTRIAL-PRAIRIE.

COMPOSITAE (ASTERACEAE)**Aster or Daisy Family**

Several species are reported here based only upon annotations made by E. G. Voss and mapped in his treatment of this family for Volume III of The Michigan Flora, (1996). *Solidago sempervirens* L. Sea-side Goldenrod, probably occurs in Kalamazoo County but is not listed below. I observed a single individual of what appeared to be this species growing in a gap in a cement barrier in the expressway

median of I-94, approximately 100 meters W of the 9th St. exit ramp in September 1999. This plant was not collected, but through my car window (I was stuck in traffic) I could see that it had the rather succulent, entire leaves, among other features characteristic of this species. *Helianthus grosseserratus* M. Martens should be expected to occur in Kalamazoo County, but I have seen no plants or herbarium specimen(s). It should be looked for in open wetlands.

***Achillea millefolium* L.**

Yarrow; Milfoil

Common. RR rights-of-way, roadsides, old fields, and other open disturbed situations. Includes the Haneses' (1947) *A. asplenifolia*. Both native and introduced plants probably occur here (Voss 1996).

Ambrosia artemisiifolia* L. Hanes: *A. elatior

Common Ragweed

Common in a diversity of open disturbed situations.

Ambrosia psilostachya* DC. Hanes: *A. coronopifolia

Western Ragweed

Current status unknown. Collected by the Haneses from a RR right-of-way W of Schoolcraft, and along this same RR right-of-way in section 36 of Charleston Tp. Not native.

***Ambrosia trifida* L.**

Giant Ragweed

Common. Moist thickets, forest edges, RR rights-of-way, old fields, and roadsides.

***Anaphalis margaritacea* (L.) Benth**

Pearly Everlasting

Occasional at OAK-HARDWOOD-FOREST edges, in WET-PRAIRIE, and in open dry old fields.

Antennaria howellii* Greene Hanes: *A. neodioica* & *A. petaloidea

Occasional in a diversity of relatively open, dry, sandy situations.

***Antennaria neglecta* Greene**

Pussytoes

Occasional. Dry old fields and RR rights-of-way.

***Antennaria parlinii* Fernald**

Parlin's Pussytoes

Occasional. Dry wooded hillsides in OAK-HARDWOOD-FOREST and hillside prairie. The Haneses' (1947) *A. fallax*, *A. munda*, & *A. plantaginifolia* can probably be referred here.

***Anthemis arvensis* L.**

Corn Chamomile

Occasional? Open disturbed situations such as roadsides and lawns. Not native.

***Anthemis cotula* L.**

Mayweed; Dog-fennel; Stinking Chamomile

Occasional? Old fields and similar weedy open habitats. Not native.

***Anthemis tinctoria* L.**

Yellow Chamomile; Golden Marguerite

Collected by the Haneses from a "roadside" in section 15 of Texas Tp. "W of Bass Lake" (MICH). Not native. Not in Hanes & Hanes (1947).

***Arctium minus* Bernh.**

Common Burdock

Common. Disturbed ground including roadsides, old fields, RR rights-of-way, and wood edges. Widely established.

Arnoglossum atriplicifolium (L.) H. Rob. *Cacalia atriplicifolia* L. in Hanes & Hanes, 1947.
Pale Indian Plantain

Collected by the Haneses from OAK-HARDWOOD-FOREST, WET-PRAIRIE, TERRESTRIAL-PRAIRIE, BUR-OAK-SAVANNA, and WHITE-OAK-SAVANNA. *Arnoglossum atriplicifolium* can be a good indicator of potentially recoverable oak savanna when found in association with other prairie and/or savanna plants. This species has declined considerably in recent years due to succession in oak savannas, and development (pers. obs., R. W. Pippen pers. comm.) (Athey & Pippen 1987).

Arnoglossum plantagineum (Raf.) *Cacalia tuberosa* in Hanes & Hanes, 1947.
Tuberous Indian Plantain

Occasional. Wet FEN sedge meadows associated with *Platanthera dilatata*, *Calopogon tuberosus*, *Triglochin maritimum*, and *Menyanthes trifoliata*. At one site protected by the Michigan Nature Association, thousands of plants grow in a near monoculture in a very wet marly FEN sedge meadow (Figure 10).

Artemisia abrotanum L.
Southernwood

Current status unknown. Collected by the Haneses from "roadsides near Eagle Lake", and from section 33 of Texas Tp. Not native.

Artemisia absinthium L.

Absinth; Common Wormwood

Occasional? Open sandy disturbed situations. Not native.

Artemisia biennis Willd.
Biennial Wormwood

Current status unknown. Collected by the Haneses from a roadside on "Island No. 4" in the Kalamazoo River (Cooper Tp.). Not native.

Artemisia campestris L. **Hanes:** *A. caudata*
Wild Wormwood

Occasional. Roadsides, RR rights-of-way, and BLACK-OAK-BARREN.

Artemisia ludoviciana Nutt.
Western Mugwort

Current status unknown. Mapped by Voss (1996). Possibly adventive. Not in Hanes & Hanes (1947).

Artemisia pontica L.
Roman Wormwood

Current status unknown. Roadsides. Not native. Not in Hanes & Hanes (1947).

Aster borealis (T. & G.) Prov. **Hanes:** *A. junciformis*
Rush Aster

Occasional. FEN and WET-MEADOW.

Aster cordifolius L.
Heart-leaved or Blue Wood Aster

Rare. Rich SUGAR-MAPLE-FOREST, HARDWOOD-SWAMP, and FLOODPLAIN-FOREST, mostly in the N½ of the county. Includes the Haneses' (1947) *A. finkii*.

Aster dumosus L.
Bushy Aster

Occasional. Sandy soil of BLACK-OAK-BARREN and COASTAL-PLAIN-MARSH. Typically found near sandy lakeshores, and most frequent in the W½ of the county. Apparently once relatively common, but now at best occasional due to habitat loss along sandy lakeshores.

Aster ericoides L.

Rare. Collected by the Haneses from several roadsides, fencerows, and RR rights-of-way through former TERRESTRIAL-PRAIRIE on Prairie Ronde. Also known from WHITE-OAK-SAVANNA along a RR right-of-way near Richland.

Aster laevis L.

Smooth Aster

Occasional. Old fields, roadsides and RR rights-of-way through TERRESTRIAL-PRAIRIE, in BLACK-OAK-BARREN, and on relatively open hillsides in OAK-HARDWOOD-FOREST. Includes the Haneses' (1947) *A. lowrieanus*.

A hybrid is known from Kalamazoo County between *A. laevis* and *A. lanceolatus* that the Haneses (1947) called *A. concinnus*.

Aster lanceolatus Willd. **Hanes:** *A. paniculatus* & *A. interior*

Panicled Aster

Occasional in a diversity of moist to wet, open to lightly shaded situations. Many specimens are difficult to place, probably owing to hybridization with other *Aster* spp.

Aster lateriflorus (L.) Britton

Calico Aster

Rare? Roadsides through HARDWOOD-SWAMP, RED-MAPLE-SWAMP, rich SUGAR-MAPLE-FOREST, and TAMARACK-SWAMP.

Aster macrophyllus L.

Large- or Big-leaved Aster

Occasional. OAK-HARDWOOD-FOREST, often on hillsides, and in former hillside prairie.

Aster novae-angliae L.

New England Aster

Common. Roadsides, WET-PRAIRIE, TERRESTRIAL-PRAIRIE, FEN, and WET-MEADOW.

Aster ontarionis Wiegand **Hanes:** *A. pantotrichus*

Lake Ontario Aster

Current status uncertain. Clearly very rare if still extant. Collected by the Haneses and only from "Crane Town near the swamp along Flowerfield Creek," and from "Smith apple orchard, west of Schoolcraft."

Aster oolentangiensis Riddell **Hanes:** *A. azureus*

Sky-blue Aster

Occasional. Dry sandy soil in areas once occupied by BLACK-OAK-BARREN and WHITE-OAK-SAVANNA.

Aster paternus Cronquist.

White-topped Aster

Extinct. Collected only once in our county (and state), on 31 August 1918 in "dry ground" at Galesburg by O. A. Farwell (*Farwell 5097a*, GH) (Farwell 1923). Possibly introduced from S of Michigan. Not in Hanes & Hanes (1947).

Aster pilosus Willd.

Frost Aster

Rare on roadsides through former TERRESTRIAL-PRAIRIE, mostly in the SW¼ of the county. No longer known from most other parts of the county. Once apparently rare throughout in oak savanna, but not recently observed or collected from remnant savanna.

***Aster praealtus* Poiret**

Willow Aster

Current status uncertain, very rare if still extant. Known from only one collection made by C. R. Hanes on 11 September 1936 at Spring Brook (Cooper Tp.). Not in Hanes & Hanes (1947).

***Aster puniceus* L.**

Swamp or Purple-stemmed Aster

Occasional. FEN, WET-MEADOW, SHRUB-CARR, WET-PRAIRIE, and TERRESTRIAL-PRAIRIE. Includes the Haneses' (1947) *A. lucidulus* and *A. firmus*.

***Aster sagittifolius* Willd.**

Arrow-leaved Aster

Occasional. Relatively open, well-drained SUGAR-MAPLE-FOREST, and OAK-HARDWOOD-FOREST. The Haneses' *A. drummondii* is included here as scarcely distinct from this species (Voss 1996).

***Aster sericeus* Vent.**

Silky Aster

Extinct. Collected by the Haneses from roadsides and RR rights-of-way through former TERRESTRIAL-PRAIRIE, and from a hillside prairie on the E bank of Pretty Lake. Now extinct at all previously known sites despite extensive searches made by multiple investigators over many years. Last seen (but not collected) by R. Brewer in 1965 along a RR right-of-way S of XY Avenue in Schoolcraft. This site has since been partly bulldozed.

***Aster shortii* Lindley**

Short's Aster

Current status uncertain, very rare if still extant. Collected by the Haneses from "the H. R. Becker woods" and from "hilly woodlands" in section 30 (both Charleston Tp.).

***Aster umbellatus* Miller**

Flat-topped Aster

Occasional. FEN, WET-MEADOW, WET-PRAIRIE, and roadsides and RR rights-of-way through former TERRESTRIAL-PRAIRIE.

***Bellis perennis* L.**

English Daisy

Occasional. Lawns. Locally established.

Bidens cernuus* L. Hanes: *B. cernua

Nodding Beggar-ticks

Occasional. BOG, FEN, WET-PRAIRIE, WET-MEADOW, EM-MARSH, roadside ditches, and other wet situations.

Bidens comosus* (A. Gray) Wiegand. Hanes: *B. comosa

Leafy-bracted Bur Marigold

Occasional in a diversity of open wet situations.

Bidens connatus* Willd. Hanes: *B. connata

Purple-stemmed Bur Marigold

Occasional in the W½ of the county on sandy lakeshores, often in COASTAL-PLAIN- MARSH.

Bidens coronatus* (L.) Britton Hanes: *B. coronata

Tickseed-sunflower

Common. FEN, BOG, WET-MEADOW, EM-MARSH, and WET-PRAIRIE.

Bidens discoideus* (T. & G.) Britton Hanes: *B. discoidea

Small Beggarticks

Current status uncertain. Mostly in the S½ of the county in mud on lakeshores.

Bidens frondosus* L. Hanes: *B. frondosa

Beggarticks

Occasional. Lawns, roadsides, and almost anywhere else with some direct sun and relatively moist soil.

Bidens vulgatus* Greene Hanes: *B. vulgata

Common Beggarticks

Occasional. Lawns and other disturbed, wet situations including ditches and RR rights-of-way.

Carduus acanthoides* L. Hanes: *Carduus crispus

Reports of *Carduus crispus* L., (Plumeless Thistle), from Kalamazoo County seem to be mis-identifications of this species (see Voss 1996). Known only from a collection made by the Haneses on 24 June 1936 from a pasture field at Coopers Glen. Not native.

***Centaurea cyanus* L.**

Bachelor's-button; Cornflower

Current status unknown. Collected by the Haneses from two locations in section 16 of Ross Tp. Not native.

***Centaurea diffusa* Lam.**

White-flowered or Tumble Knapweed

Current status unknown. First collected in Michigan in 1943 on the S boundary of Section 35 Richland Tp. (Hanes 1945b; Voss 1996). Not native.

***Centaurea jacea* L.**

Brown Knapweed

Current status unknown. Collected by the Haneses from a roadside in Section 29 Texas Tp. Not native. Includes the Haneses (1947) *C. nigra*.

Centaurea ×pratensis (*C. jacea* × *C. nigra*) is a rare introduction collected by the Haneses in Alamo Tp. Current status unknown.

***Centaurea maculosa* Lam.**

Spotted Knapweed

Common. Dry open disturbed situations. A mild calciphile (R. Brewer pers. comm. 2001). Widely established.

Centaurea repens* L. Hanes: *C. picris

Russian Knapweed

Current status unknown. The most recent Michigan collection was made in 1946 by the Haneses from "the Grand Trunk railway 1 mi. W of Schoolcraft" (Hanes 1938; Voss 1996). Not native.

***Chondrilla juncea* L.**

Skeleton-weed

First collected in the county (and the state) in 1934 near West Lake. Now occasional throughout in open sandy situations, especially in Alamo Tp. Not native.

***Chrysanthemum balsamita* L.**

Costmary; Mint-geranium

Current status unknown. Known from open disturbed situations. Not native.

***Chrysanthemum leucanthemum* L.**

Ox-eye Daisy

Common in open disturbed situations including roadsides, RR rights-of-way, and old fields. Not native.

***Cichorium intybus* L.**

Chickory; Blue-sailors

Common. Roadsides, RR rights-of-way, fencerows, and lawns. Widely established.

Cirsium altissimum (L.) Sprengel

Tall Thistle

Occasional. Often found at the interface of OAK-HARDWOOD-FOREST with FEN or BOG. Probably once occurred in moist oak savanna.

Cirsium arvense (L.) Scop.

Canada or Field Thistle

Common in a diversity of open situations, especially moist old fields. Widely established.

Cirsium discolor (Willd.) Sprengel

Pasture Thistle

Occasional. Mostly in the SW $\frac{1}{4}$ of the county along RR rights-of-way, on roadsides, in FEN, WET-PRAIRIE, WHITE-OAK-SAVANNA, and TERRESTRIAL-PRAIRIE.

Cirsium hillii (Canby) Fernald

Hill's Thistle

Very rare. Collected by the Haneses from a RR right-of-way S of Portage, roadsides through former TERRESTRIAL-PRAIRIE near Schoolcraft, in Harrison Cemetery NW of Schoolcraft (unplowed TERRESTRIAL-PRAIRIE), and a cemetery in section 34 of Portage Tp. Reported in the collection notes of Burgess (see *Linum usitatissimum*) from "railroad banks" in Portage (BUR-OAK-SAVANNA/WHITE-OAK-SAVANNA) on 17 June 1903. Hill's Thistle may have been associated with *Amorpha canescens*, *Anemone cylindrica*, *Asclepias purpurascens*, *Galium boreale*, *Helianthemum virginianum*, *Lupinus perennis*, *Rosa carolina*, *Rudbeckia hirta*, *Smilacina racemosa*, *Tephrosia virginiana*, and other TERRESTRIAL-PRAIRIE and oak savanna plants noted in a ledger of specimens that he collected at this site. Collected by C. N. Harvey 6 July 1939 from a meadow along the "Fruit Belt Line". Collected by L. A. Kenoyer from grassland associated with the "old railway near campus" [the former MI Central RR right-of-way near the WMU campus] in 1931. A rosette was seen in 2002 in overgrown TERRESTRIAL-PRAIRIE/WHITE-OAK-SAVANNA along the former MI Central RR right-of-way W of Stadium Drive Apartments near Stadium Dr. (more or less across from K-mart). This is the same former right-of-way where the Harvey and Kenoyer collections were made. The plant was growing in a very small opening along the former right-of-way in dry-mesic loamy sand. Immediate associates included *Andropogon gerardii*, *Carex pensylvanica*, *Prunus serotina*, and *Quercus alba*. This once open site is now nearly covered with trees and shrubs. This is another of our nearly extinct, formerly somewhat common prairie/savanna plants.

Cirsium muticum Michaux

Swamp Thistle

Occasional. FEN, WET-PRAIRIE, WET-MEADOW, and quite generally along lakeshores throughout.

Cirsium vulgare (Savi) Tenore

Bull Thistle

Common. Pastures, roadsides, RR rights-of-way, and other open disturbed situations. Widely established.

Conyza canadensis (L.) Cronquist **Hanes:** *Erigeron canadensis*

Horseweed

Common in a diversity of open situations. Probably most abundant in the first or second year of old field succession, especially in cornfields (R. Brewer pers. comm. 2001).

Coreopsis grandiflora Sweet

Big Coreopsis

Current status unknown. Known by the Haneses from a single colony along a RR right-of-way 6 mi. W of Schoolcraft (Hanes 1938). Not native.

Coreopsis lanceolata L.

Lance Tickseed

Collected by the Haneses from sandy oak savanna in the south-central part of the county. Now occa-

sional throughout along dry roadsides, and in prairie plantings. Probably at least in part adventive/escaped here. Cultivated plants readily spread to nearby dry roadsides.

***Coreopsis palmata* Nutt.**

Finger or Prairie Coreopsis

Very rare. Collected by the Haneses from the SW $\frac{1}{4}$ of the county at the edge of "oak woods and thickets", and along RR rights-of-way on Prairie Ronde in former TERRESTRIAL-PRAIRIE, BUR-OAK-SAVANNA, and WHITE-OAK-SAVANNA. Now rare in sandy oak savanna at the Hampton Creek Consumer's Power right-of-way, and as a relict of former TERRESTRIAL-PRAIRIE and WHITE-OAK-SAVANNA in a few other locations. Most of the very few remaining plants occur in overgrown oak savanna near the intersection of Centre St. and US 131. Occasionally cultivated. Collected in 1838 on Gull Prairie by the first botanical survey. Probably once modal in blacksoil TERRESTRIAL-PRAIRIE and adjacent oak savannas. Nearly extinct.

Coreopsis tinctoria* Nutt. Hanes: *Thelesperma trifidum

Plains Coreopsis; Calliopsis

Current status unknown. Collected by the Haneses along a RR right-of-way W of Schoolcraft. Adventive.

***Coreopsis tripteris* L.**

Tall Tickseed; Tall Coreopsis

Occasional. BLACK-OAK-BARREN, WHITE-OAK-SAVANNA, BUR-OAK-SAVANNA, TERRESTRIAL-PRAIRIE, and WET-PRAIRIE. A persistent prairie and oak savanna generalist.

***Cosmos bipinnatus* Cav.**

Current status unknown. Collected by the Haneses 25 September 1935 from "waste places" in Pavilion Tp. (MICH). An escape from cultivation.

***Cosmos sulphureus* Cav.**

Collected in 1942 from along a roadside W of Schoolcraft by the Haneses. No longer known.

***Crepis capillaris* (L.) Wallr.**

Smooth Hawk's-beard

Current status unknown. Collected by the Haneses from the S $\frac{1}{2}$ of the county in lawns. Not native.

Echinacea pallida* (Nutt.) Nutt. Hanes: *Brauneria pallida

Pale-purple Coneflower

Extinct. Collected by the Haneses from along a RR right-of-way W of Indian Lake, and "near Camp Custer." May not be native here.

***Echinacea purpurea* (L.) Moench**

Collected by the first botanical survey in 1838 on Gull Prairie (Richland Tp.) and thought to be native. Now extinct as a native plant, but appearing occasionally along expressways and in other roadside situations, probably from seed spread by cultivated plants. Widely planted. Not in Hanes & Hanes (1947).

***Echinops sphaerocephalus* L.**

Globe-thistle

Collected by the Haneses from along a roadside in Kalamazoo Tp. on 8 August 1936. No longer known. Not native. Not in Hanes & Hanes (1947).

***Erechtites hieraciifolia* (L.) DC.**

Fireweed

Occasional. Moist lawns, old fields, and other disturbed situations.

***Erigeron annuus* (L.) Pers.**

Daisy Fleabane

Common. Roadsides, RR rights-of-way, and old fields.

***Erigeron philadelphicus* L.**

Common or Philadelphia Fleabane

Occasional in forests.

***Erigeron pulchellus* Michaux**

Robin's-plantain

Current status uncertain, very rare if still extant. Dry OAK-HARDWOOD-FOREST. Probably once also occurred in oak savanna.

***Erigeron strigosus* Willd.**

Daisy Fleabane

Occasional. RR rights-of-way and other open disturbed situations.

***Eupatorium altissimum* L.**

Tall Boneset

Current status unknown. First collected by S. R. Crispin on 29 August 1979 from the NW¼ NW¼ of section 21 of Schoolcraft Tp. ca. ¼ mi. E of 16th St. where it was "rare on open right-of-way on N side of GTW RR" (MSC). Adventive. Not in Hanes & Hanes (1947).***Eupatorium maculatum* L.**

Joe-pye-weed

Common. FEN, WET-MEADOW, WET-PRAIRIE, and old fields.

***Eupatorium perfoliatum* L.**

Boneset

Common. FEN, SHRUB-CARR, COASTAL-PLAIN-MARSH, and WET-PRAIRIE.

***Eupatorium purpureum* L.**

Green-stemmed Joe-pye-weed

Occasional in rich upland forest.

***Eupatorium rugosum* Houtt.**

White Snakeroot

Occasional. SUGAR-MAPLE-FOREST, HARDWOOD-SWAMP, and FLOODPLAIN-FOREST.

***Eupatorium sessilifolium* L.**

Upland Boneset

Extinct. Known only from collections made by the Haneses from thinly wooded ridges in Charleston Tp. Today the area is closed canopy OAK-HARDWOOD-FOREST.

Euthamia graminifolia* (L.) Nutt. Hanes: *Solidago graminifolia

Flat-topped, Bushy, or Grass-leaved Goldenrod

Common. A diversity of open, moist to wet situations, often near lakeshores.

Euthamia remota* Greene Hanes: *Solidago graminifolia* var. *remota

Occasional. Usually in wet peaty sand near seepage areas, and in COASTAL-PLAIN-MARSH in the W½ of the county (Hanes 1945a). Persists at many former/current sites for COASTAL-PLAIN-MARSH.

Gaillardia pulchella* Foug. Hanes: *G. aristata

Great-flowered Gaillardia

Current status unknown. Collected by the Haneses from roadsides, a ditch, and near Stony Lake. Not native.

***Galinsoga parviflora* Cav.**

Current status uncertain. Moist lawns and roadsides. Not native. Not in Hanes & Hanes (1947).

Galinsoga quadriradiata* Cav. Hanes: *G. ciliata

Quickweed

Current status uncertain. Moist lawns and roadsides. Not native.

***Gnaphalium macounii* Greene**

Clammy Cudweed

Current status unknown. BLACK-OAK-BARREN and openings in OAK-HARDWOOD-FOREST.

***Gnaphalium obtusifolium* L.**

Fragrant Cudweed

Occasional. Dry old fields and disturbed BLACK-OAK-BARREN.

***Gnaphalium purpureum* L.**

Purple Cudweed

Current status unknown. Collected by the Haneses from sandy old fields. Not native.

***Gnaphalium uliginosum* L.**

Low Cudweed

Current status uncertain. Known from moist soil in roadside ditches and pond edges. Not native.

***Grindelia squarrosa* (Pursh) Dunal**

Gumweed

Extinct. Collected by the Haneses from roadsides and fencerows, mostly, if not entirely on former prairies. Last collected by R. Brewer in the early 1960s from a fencerow in former TERRESTRIAL-PRAIRIE near Stadium Dr. This site was later destroyed by road construction (see *Eryngium yuccifolium*). No recent collections or reports are known, and no previous sites still hold this species, possibly adventive.

***Guizotia abyssinica* (L. f.) Cass.**

Niger-seed

Current status unknown. Collected in 1976 from a parking lot in Richland by Gillis (13473 MSC). Not native. Not in Hanes & Hanes (1947).

***Helenium autumnale* L.**

Common Sneezeweed

Current status unknown. Collected by the Haneses from a RR right-of-way E of Schoolcraft and from a "swamp" along the Kalamazoo River E of Comstock.

Helenium flexuosum* Raf. Hanes: *H. nudiflorum

Purple-headed Sneezeweed

Current status unknown. Known only from a specimen collected near Camp Custer by H. R. Becker (Hermann 1936). Not native.

***Helianthus annuus* L.**

Common Sunflower

An occasional escape from cultivation throughout the county along roadsides and RR rights-of-way.

***Helianthus decapetalus* L.**

Thin-leaved Sunflower

Occasional. Open swampy forests and along roadsides through former WET-PRAIRIE.

***Helianthus divaricatus* L.**

Woodland Sunflower

Common. BLACK-OAK-BARREN, OAK-HARDWOOD-FOREST (especially edges), and along dry RR rights-of-way and roadsides.

The hybrid *Helianthus ×ambiguus* (*H. divaricatus* × *H. giganteus*) has been collected in Kalamazoo county.

***Helianthus giganteus* L.**

Tall Sunflower

Occasional. FEN, WET-PRAIRIE, WET-MEADOW, and roadside ditches. Known to hybridize with *H. divaricatus* forming the named hybrid *Helianthus ×ambiguus* (see *H. divaricatus*).

***Helianthus hirsutus* Raf.**

Hairy Sunflower

Current status uncertain, very rare if still extant. Collected by the Haneses on 13 July 1937, 1 mi. W of Vicksburg along a RR right-of-way in sandy soil. No other collections are known. Not in Hanes & Hanes (1947).

***Helianthus maximilianii* Schrader**

Maximilian Sunflower

Extinct. Collected by the Haneses from a RR right-of-way in Schoolcraft where it had in 1943 "persisted for many years." No longer known. Possibly adventive.

***Helianthus mollis* Lam.**

Ashy or Downy Sunflower

Very rare. Collected by the Haneses from a RR right-of-way SW of Schoolcraft, and more recently (1994) by P. Higman (MNFI) from savanna-like openings in Fort Custer.

***Helianthus occidentalis* Riddell**

Western Sunflower

Rare as a relict of TERRESTRIAL-PRAIRIE, and oak savanna throughout. A good indicator of quality remnant oak savanna and prairie when found in association with other typical prairie/savanna species.

Helianthus pauciflorus* Nutt. Hanes: *H. rigidus

Prairie Sunflower

Rare. RR rights-of-way through former TERRESTRIAL-PRAIRIE in the S½ of the county.

The hybrid *Helianthus ×laetiflorus* (*H. pauciflorus* × *H. tuberosus*) has been collected in Kalamazoo County.

***Helianthus petiolaris* Nutt.**

Plains Sunflower

Extinct. Known only from a Hanes collection 1 mi. E of Schoolcraft along a RR right-of-way. No longer known. Possibly adventive.

***Helianthus strumosus* L.**

Pale-leaved Sunflower

Rare. RR rights-of-way, roadsides, fencerows, TERRESTRIAL-PRAIRIE, BUR-OAK-SAVANNA, and WHITE-OAK-SAVANNA, mostly in the SW¼ of the county.

***Helianthus tuberosus* L.**

Jerusalem-artichoke

Occasional. Mostly in the SW¼ of the county, and especially in fencerows and along roadsides and RR rights-of-way. Especially frequent on Prairie Ronde and Gourdneck Prairie. This was a popular natural food in the 1960s and was widely planted for human consumption. It was also probably cultivated by Native Americans (R. Brewer pers. comm.). Known to hybridize with *H. pauciflorus* forming the named hybrid *Helianthus ×laetiflorus* (see *H. pauciflorus*).

***Heliopsis helianthoides* (L.) Sweet**

False Sunflower

Occasional. RR rights-of-way, roadsides, and fencerows. Especially frequent in the vicinity of Prairie Ronde and Gourdneck Prairie.

***Hieracium aurantiacum* L.**

Orange Hawkweed; Devil's-paintbrush

Common. Dry open disturbed situations including lawns, roadsides, and RR rights-of-way. Not native.

***Hieracium caespitosum* Dumort**

King Devil; Yellow Hawkweed

Occasional. Disturbed situations along roadsides, in lawns, and in old fields. Not native. Not in Hanes & Hanes (1947).

***Hieracium gronovii* L.**

Hairy Hawkweed

Occasional. Mostly in the W½ of the county in OAK-HARDWOOD-FOREST, old fields, and sandy former BLACK-OAK-BARREN.

Hieracium kalmii* L. Hanes: *H. canadense

Canada Hawkweed

Current status uncertain. Relatively dry sandy situations along RR rights-of-way and at OAK-HARDWOOD-FOREST edges.

***Hieracium longipilum* Hooker**

Prairie or Long-bearded Hawkweed

Current status uncertain. Dry, sandy soil along RR rights-of-way, and in old fields.

***Hieracium paniculatum* L.**

Current status uncertain. Similar situations as *H. kalmii* (sandy situations along RR rights-of-way and OAK-HARDWOOD-FOREST edges), but not usually as dry. Not in Hanes & Hanes (1947).

***Hieracium piloselloides* Vill.**

King Devil; Yellow Hawkweed

Current status unknown. First collected by R. W. Pippen 12 June 1969 from ½ mi. S of the intersection of Center St. and US 131 in the Gourdneck State Game Area. Here it was frequent in dry open old fields. Not native. Not in Hanes & Hanes (1947).

***Hieracium scabrum* Michaux**

Rough Hawkweed

Current status uncertain. Hilly OAK-HARDWOOD-FOREST and old fields.

***Hieracium venosum* L.**

Rattlesnake-weed; Veined Hawkweed

Current status uncertain, very rare if still extant. Collected only by the Haneses in an "oak wood" in section 24 of Cooper Tp.

***Hypochaeris radicata* L.**

Cat's-ear

First collected 1 July 1938 by the Haneses from a Schoolcraft yard. Now occasional throughout. Like the Hawkweeds, does well in dry lawns and old fields. Not native.

***Inula helenium* L.**

Elecampane

Current status uncertain. Usually near roadways. Not native.

***Iva xanthifolia* Nutt.**

Marsh Elder

Current status unknown. Collected by the Haneses from roadsides. Not native.

***Krigia biflora* (Walter) S. F. Blake**

Cynthia

Rare. Oak savanna and TERRESTRIAL-PRAIRIE. A good indicator of former savanna/prairie.

***Krigia virginica* (L.) Willd.**

Dwarf Dandelion

Rare. BLACK-OAK-BARREN and OAK-HARDWOOD-FOREST.

***Kuhnia eupatorioides* L.**

False Boneset

Very rare. Once occasional along roadsides, RR rights-of-way, in fencerows, and in remnant WHITE-OAK-SAVANNA, TERRESTRIAL-PRAIRIE, and BLACK-OAK-BARREN. This species is now nearly extinct.

***Lactuca biennis* (Moench) Fernald**

Tall Blue Lettuce

Occasional. At wood edges and openings in HARDWOOD-SWAMP and RED-MAPLE-SWAMP.

***Lactuca canadensis* L.**

Wild Lettuce

Occasional in a diversity of open disturbed situations.

***Lactuca saligna* L.**

Willow-leaved Lettuce

Current status unknown. Only known collection was made by P. J. Higman in 1993 from a dry, weedy roadside depression on the E side of Longman Rd. approximately .4 mi. N of I-94 in section 24 of Charleston Tp. (MICH). Not native. Not in Hanes & Hanes (1947).

Lactuca serriola* L. Hanes: *L. scariola

Prickly Lettuce

Common. Open disturbed areas, especially construction sites, weedy lawns, and roadsides. Not native.

***Lapsana communis* L.**

Nipplewort

Occasional in open disturbed situations. Not native. Not in Hanes & Hanes (1947).

Liatris aspera* Michaux Hanes: *L. sphaeroidea

Blazing Star

Rare. Relatively dry and sandy WHITE-OAK-SAVANNA (including hillside prairies), TERRESTRIAL-PRAIRIE, BLACK-OAK-BARREN, and open OAK-HARDWOOD-FOREST, mostly in the W½ of the county. Probably once modal in BLACK-OAK-BARREN. Shrub growth, canopy closure, and other habitat destruction have led to the relatively rapid decline of this once common species. Perhaps the largest remaining colony persists in oak savanna and old fields along the old Fruit Belt RR approximately 500m NW of the intersection of O Ave. and 4th St. The area was surveyed for a new subdivision in 2002, and a large area had been bulldozed on a slightly later trip I made to the site. I encountered an albino plant here (f. *benkei*) in fall 2002. The Haneses report this albino forma from a former site E of Sugarloaf Lake.***Liatris cylindracea* Michaux**

Cylindric Blazing Star

Very rare. Collected by the Haneses from very dry, open, and sandy situations in former BLACK-OAK-BARREN in the W½ of the county. Once occasional, but now nearly extinct. The last large

population that I know (in the Gourdneck State Game Area) has declined significantly over the last 30+ years (R. W. Pippen pers. comm.). Probably once modal in open sandy BLACK-OAK-BARREN.

***Liatris punctata* Hooker**

Dotted Button Snakeroot

Extinct. Two plants were long known by the Haneses from along a roadside on Prairie Ronde. In Florence Haneses diary she mentions that she and Clarence intended to photograph the plants before digging one up and planting it in their home garden for closer study. It is unclear if they ever dug one of the plants. In 1936 the Haneses noted that the plants were known at this site for at least 30 yrs. Road widening and mowing may have destroyed these plants which were last seen in 1953 (Hanes diary). This site was located $\frac{1}{2}$ – $\frac{3}{4}$ mi. NE of Schoolcraft along the roadside and the plants may have been associated with *Silphium integrifolium* and other prairie plants collected by the Haneses in this general area (see Gaiser 1950; Hermann 1936). Only record of this species from Michigan. Thought to be native, but disjunct from other known occurrences.

Liatris scariosa* (L.) Willd. Hanes: *L. xdeamii* & *L. novae-angliae

Rare. Collected by the Haneses mostly from overgrown WHITE-OAK-SAVANNA (including open OAK-HARDWOOD-FOREST) and collected by R. Brewer from the former right-of-way of the MI Central RR on the north edge of Genesee Prairie (very close to much former WHITE-OAK-SAVANNA). Apparently restricted, or nearly so to WHITE-OAK-SAVANNA and adjacent TERRESTRIAL-PRAIRIE. Once probably modal in WHITE-OAK-SAVANNA.

***Liatris spicata* Willd.**

Gay Feather

Occasional. FEN sedge meadow. Reported by Brewer (1965) from an unusually high-quality WET-PRAIRIE within the right-of-way of the former MI Central RR near the WMU campus (this prairie was covered with fill in 1963–1964) (R. Brewer pers. comm.).

Matricaria discoidea* DC. Hanes: *M. matricarioides

Pineapple-weed

Common. Roadsides, lawns, gravel parking lots, and other waste places. Widely established.

***Megalodonta beckii* (Sprengel) Greene**

Water-marigold

Current status unknown. Collected by the Haneses from Oatman Lake and the easternmost lake of Three Lakes (Richland Tp.).

***Parthenium hispidum* Raf.**

Hairy Parthenium

Current status uncertain, very rare if still extant. Collected by the Haneses from a RR right-of-way W of Schoolcraft. Last collected here in 1969. Only known Michigan collection. Possibly adventive.

***Polymnia canadensis* L.**

White-flowered Leafcup

Current status uncertain. Known by the Haneses from openings along the Kalamazoo River E of Kalamazoo, and from HARDWOOD-SWAMP alongside creeks.

***Prenanthes alba* L.**

White Lettuce

Occasional. OAK-HARDWOOD-FOREST and SUGAR-MAPLE-FOREST, often on hillsides. The most frequently encountered *Prenanthes* in our terrestrial forests.

***Prenanthes altissima* L.**

Tall White Lettuce

Occasional. Openings in HARDWOOD-SWAMP and RED-MAPLE-SWAMP.

***Prenanthes racemosa* Michaux**

Glaucous White Lettuce

Current status uncertain. FEN, WET-MEADOW, and lakeshores, mostly in the S½ of the county.

***Ratibida columnifera* (Nutt.) Wooten & Standley**

Long-headed Coneflower

Known from one collection made by H. R. Becker on 10 July 1936 from dry soil at "Camp Custer" (Hanes 1938). The Haneses noted that it was "possibly brought in with western hay." No longer known. Probably not native.

***Ratibida pinnata* (Vent.) Barnhart**

Yellow Coneflower

Occasional along RR rights-of-way and roadsides, especially in the vicinity of former TERRESTRIAL-PRAIRIE. Also known from WET-PRAIRIE, BUR-OAK-SAVANNA, and WHITE-OAK-SAVANNA. Widely utilized in "prairie plantings."

Rudbeckia fulgida* Aiton Hanes: *R. sullivanti

Showy Coneflower

Occasional. FEN and alkaline WET-MEADOW, mostly in the N½ of the county. All our specimens are of the var. *speciosa*.***Rudbeckia hirta* L.**

Black-eyed Susan

Common. Dry roadsides and RR rights-of-way, oak savanna, TERRESTRIAL-PRAIRIE, FEN, WET-MEADOW, and lakeshores. Both introduced and native plants occur here.

***Rudbeckia laciniata* L.**

Tall or Cutleaf Coneflower

Occasional. WET-PRAIRIE, WET-MEADOW, FEN, and other open wet situations.

***Rudbeckia triloba* L.**

Brown-eyed Susan

Current status unknown. Known by the Haneses as "an infrequent escape" in wetlands and along a RR right-of-way. Probably native in wetlands, and introduced along the RR right-of-way (Voss 1996).

***Senecio aureus* L.**

Golden Ragwort

Common. Open to wooded areas in FEN, and quite generally in wet, alkaline situations in TAMARACK-SWAMP, HARDWOOD-SWAMP, RED-MAPLE-SWAMP, SHRUB-CARR, and other thickets (especially near streams). Often associated with *Cypripedium calceolus*.***Senecio pauperculus* Michaux**

Northern Ragwort

Current status uncertain, very rare if still extant. Collected by the Haneses from a "moist grassy meadow E of Paw Paw Lake" (1943).

***Senecio plattensis* Nutt.**

Prairie Ragwort

Current status uncertain. Mostly in the W½ of the county in BLACK-OAK-BARREN, OAK-HARDWOOD-FOREST, and WHITE-OAK-SAVANNA.

***Silphium integrifolium* Michaux**

Entire-leaved Rosinweed

Rare. Fencerows, FEN meadow, TERRESTRIAL-PRAIRIE, BUR-OAK-SAVANNA, mesic (rather than dry-mesic) WHITE-OAK-SAVANNA, and as relicts of these plant communities along roadsides and RR rights-of-way. Known from within the boundaries of Genesee Prairie, Grand Prairie, Gourd-

neck Prairie, Gull Prairie, Prairie Ronde, and the remnant prairie along Arcadia (Bronson) Creek through and W of the WMU campus. Both the typical variety and the var. *deamii* are known from superficially native situations. Perhaps the largest remaining population grows in BUR-OAK-SAVANNA and TERRESTRIAL-PRAIRIE (including some WET-PRAIRIE) near and surrounding advertising billboards on the N side of Stadium Dr. just W of the WMU campus (on and near the right-of-way of the former MI Central RR, est. in 1847). Most plants have been mowed to the ground for the last 6 years, but when mowing subsides, such as during late summer 1996, and in fall 2002, hundreds of stems of this state threatened plant can be seen in flower. Several plants also occur further E along the RR right-of-way through the WMU campus. This site is worthy of protection, but may soon become a commercial development. Plants used to be much more abundant in this area and elsewhere on and near former TERRESTRIAL-PRAIRIE (R. W. Pippen pers. comm. 1996, pers. obs.). The only other relatively large extant population that I know of occurs in a prairie FEN in the Gourdneck State Game Area. Collected by the first botanical survey in 1838 at Gull Prairie. Probably once modal in blacksoil TERRESTRIAL-PRAIRIE and adjacent BUR-OAK-SAVANNA. This *Silphium*, rather than *S. laciniatum* or *S. terebinthinaceum*, was almost surely the dominant early fall color on our blacksoil TERRESTRIAL-PRAIRIES. The same trends (fire suppression and subsequent shrub and tree growth, road widening, removal of fencerows, and herbicide application) that have plagued many of our other prairie and savanna plants are claiming the last remaining populations of this once extremely common plant.

***Silphium laciniatum* L.**

Compass Plant

Extinct. Known only from two stems that grew along the RR right-of-way just NE of the intersection of Howard St. and Stadium Dr. on the WMU campus. First observed about 1975 (date uncertain) by R. W. Pippen and K. Chapman. Heavy shrub growth now covers the former site, and much RR right-of-way disturbance has since occurred in the area. Last observed in 1980 by K. Chapman. There are no other reports of this species from the county. Possibly adventive, but since this site lies within the former prairie and oak savanna dominated right-of-way of the MI Central RR (est. in 1847) there is a chance it may have been native. Probably not a significant component of former blacksoil TERRESTRIAL-PRAIRIES, if it occurred in them at all. Not in Hanes & Hanes (1947).

***Silphium perfoliatum* L.**

Cup Plant

Very rare. Persisting in a single location along a RR right-of-way W of the village of Schoolcraft. The plants regularly flower and set seed. This population was first identified by the Haneses, and has now been known for at least 60 years. Possibly adventive. Widely planted throughout the county.

***Silphium terebinthinaceum* Jacq.**

Prairie-dock

Extinct. Collected by the Haneses only from "an unplowed field not far from the Portage River in section 6 of Climax Tp." Here, H. R. Becker had known there to be 30+ plants for more than 30 years previous to 1943 when the Haneses made their collection. This site was likely a wet-mesic prairie. The site, if properly relocated, is now covered by a heavy growth of *Lythrum salicaria* and *Typa latifolia*. This species has not since been collected, and is thought to be extinct in Kalamazoo County as a native species. A few plants have been seen in prairie plantings at the intersection of I-94 and Oakland Dr., in a prairie restoration near the entrance to West Lake Park, and in Harrison Prairie. The plants at Harrison Prairie are the result of seed introduced from the Michigan Nature Association Helmer Brook Fen and Prairie preserve (R. Pleznac pers. comm. 2002). The origin of the other plants is unknown. Probably not a significant component of former blacksoil TERRESTRIAL-PRAIRIE or BUR-OAK-SAVANNA, if it occurred in them at all. Prairie-dock is usually considered a mild calciphile and is sometimes associated with FEN elsewhere in southern Michigan. It is however not known from in or near FEN in Kalamazoo County.

***Solidago altissima* L.**

Tall Goldenrod

Rare. Fencerows, roadsides, RR rights-of-way through TERRESTRIAL-PRAIRIE and WET-PRAIRIE, and in wet sandy depressions, mostly in the W½ of the county.

Solidago caesia L.

Bluestem Goldenrod

Occasional. OAK-HARDWOOD-FOREST.

Solidago canadensis L. **Hanes:** *S. altissima* var. *hargeri*

Canada Goldenrod

Common. Roadsides, old fields, and other open to partly shaded, often somewhat degraded habitats. While sometimes rather weedy, it is a native component of our prairie and savanna flora.

Solidago flexicaulis L. **Hanes:** *Solidago latifolia*

Zigzag Goldenrod

Collected by the Haneses and F. W. Rapp mostly from the SE¼ of the county in poorly-drained SUGAR-MAPLE-FOREST.

Solidago gigantea Aiton

Late Goldenrod

Occasional. Moist to wet forest openings, WET-MEADOW, old fields, and WET-PRAIRIE.

Solidago hispida Willd.

Hairy Goldenrod

Rare on hillsides in open OAK-HARDWOOD-FOREST, usually near lakes.

Solidago juncea Aiton

Early Goldenrod

Occasional in old fields and along roadsides and RR rights-of-way, especially through areas of former TERRESTRIAL-PRAIRIE and oak savanna.

Solidago missouriensis Nutt. **Hanes:** *S. glaberrima*

Missouri or Prairie Goldenrod

Current status uncertain, very rare if still extant. Collected by the Haneses from a roadside on Gourd-neck Prairie (the road separating sections 11 and 12 of Schoolcraft Tp.). A collection made by Basil Stergios (526, MSC) on 2 August 1969 from "Louden old field" in section 5 of Ross Tp. is probably this species (determined by E. G. Voss). No longer occurs at the Schoolcraft Tp. collection site. Possibly overlooked elsewhere.

Solidago nemoralis Aiton

Gray Goldenrod

Occasional. Sandy old fields, BLACK-OAK-BARREN, overgrown dry to mesic WHITE-OAK-SAVANNA, and OAK-HARDWOOD-FOREST.

Solidago ohioensis Riddell

Ohio Goldenrod

Rare. Marly open FEN. Usually associated with *Liatrix spicata* and *Potentilla fruticosa* (Pringle 1982).

Solidago patula Willd.

Rough-leaved Goldenrod

Occasional. HARDWOOD-SWAMP, COASTAL-PLAIN-MARSH, and WET-MEADOW.

Solidago riddellii Frank

Riddell's Goldenrod

Rare. WET-PRAIRIE, FEN, and grassy situations along marly lakeshores (but not always in FEN). Modal (at least today) in FEN meadow where it is often associated with *Cypripedium candidum*, *Potentilla fruticosa*, and *Valeriana uliginosa*.

***Solidago rigida* L.**

Stiff Goldenrod

Occasional. Roadsides and RR rights-of-way, TERRESTRIAL-PRAIRIE, WHITE-OAK-SAVANNA, BLACK-OAK-BARREN, WET-PRAIRIE (Brewer 1965), and OAK-HARDWOOD-FOREST. Becoming relatively more common.

***Solidago rugosa* Miller**

Rough-leaved Goldenrod

Occasional. At wetland edges with OAK-HARDWOOD-FOREST.

Solidago speciosa* Nutt. Hanes: *S. rigidiuscula

Showy Goldenrod

Occasional. Old fields, OAK-HARDWOOD-FOREST edges, roadsides, and RR rights-of-way, especially through former BLACK-OAK-BARREN, WHITE-OAK-SAVANNA, and TERRESTRIAL-PRAIRIE. We have two varieties here, the relatively earlier-blooming var. *jejunifolia* (the Haneses' (1947) var. *rigidiuscula*) and the later-blooming (and somewhat more abundant and weedy) var. *speciosa*. The var. *jejunifolia* is especially abundant in dry-mesic WHITE-OAK-OPENING and in BLACK-OAK-BARREN.

***Solidago uliginosa* Nutt.**

Bog Goldenrod

Occasional. FEN.

***Solidago ulmifolia* Willd.**

Elm-leaved Goldenrod

Occasional. Sandy dry-mesic to mesic and shrubby former oak savanna and OAK-HARDWOOD-FOREST edges, primarily in the NW¼ of the county.

***Sonchus arvensis* L.**

Field or Perennial Sow-thistle

Common. Roadsides and RR rights-of-way. Not native.

***Sonchus asper* (L.) Hill**

Prickly Sow-thistle

Common in a diversity of disturbed situations. Not native.

***Sonchus oleraceus* L.**

Common Sow-thistle

Current status uncertain. Known from open disturbed situations.

***Tanacetum vulgare* L.**

Common Tansy

Occasional. Roadsides. Most frequent in the NW¼ of the county. Not native.

Taraxacum erythrospermum* Besser Hanes: *T. laevigatum

Red-seeded Dandelion

Common. Forest edges and on thinly wooded hillsides.

***Taraxacum officinale* Wiggers**

Common Dandelion

Common. Almost "everywhere" if any plant can be said to be so distributed. Widely established.

***Tragopogon dubius* Scop.**

Common. Roadsides, RR rights-of-way, and old fields. Known to form interspecific hybrids here with *T. pratensis* (Hall et al. 1966; Voss 1996). Not native.

***Tragopogon porrifolius* L.**

Salsify; Vegetable-oyster

Very rarely encountered along RR rights-of-way. Not native.

***Tragopogon pratensis* L.**

Goat's-beard

Common. Roadsides and RR rights-of-way. Forms sterile hybrids here with *T. dubius*. Not native.***Vernonia gigantea* (Walter) Branner & Coville **Hanes:** *V. altissima***

Tall Ironweed

Collected by the Haneses from E of Austin Lake and from section 12 of Alamo Tp. Reportedly "common" in WET-MEADOW and other marshland communities along the Kalamazoo River (Meagher & Tonsor 1992).

The hybrid *Vernonia ×illinoensis* (*V. gigantea* × *V. missurica*) is known from Kalamazoo County.***Vernonia missurica* Raf.**

Ironweed

Occasional. TERRESTRIAL-PRAIRIE, WET-PRAIRIE, WET-MEADOW, old fields, and FEN. Known to hybridize with *V. gigantea* forming the named hybrid *Vernonia ×illinoensis*.***Xanthium strumarium* L. **Hanes:** *X. pungens* & *X. saccharatum***

Cocklebur

Common. Open moist situations, especially in wet, recently fallow fields and near streams and the Kalamazoo River. Not native.

APPENDIX I. Incomplete List of Plants Collected in Kalamazoo County by the First Botanical Survey.

The specimen data below have been drawn exclusively from notes laboriously compiled by R. McVaugh and supplied to me by E. G. Voss. Although some specimens housed at MICH have been consulted in writing this flora, most specimens listed here have not. Since few data were associated with these notes, and since I have only seen a few of the listed specimens, I have not updated the taxonomy used, nor can I be sure that when valid names are used, the plants are properly identified. Thus, this list is intended to serve only as a starting point for those interested in the first botanical survey collections from Kalamazoo County. I have treated each apparently unique set of label data as a unique collection. However, it is possible that some specimens are listed more than once in the notes from Rogers McVaugh (see McVaugh 1970 for additional commentary, especially regarding the collection of duplicates and problems with dates and other label data). Unless otherwise indicated all specimens cited here are housed at MICH. All "Notes" are those of the present author. Approximately 16 collections are known from 1837 and 75 from 1838 (not all listed here) (McVaugh 1970).

Name	Label Data	Notes
<i>Allium tricoccum</i>	Along Kalamazoo River, July 24 1838	
<i>Allium tricoccum</i>	July 28 1838	
<i>Amaranthus retroflexus</i>	Grand Prairie, July 21 1838	
<i>Amaranthus tuberculatus</i>	August 3 1838	
<i>Amphicarpa monoida</i>	August	
<i>Andropogon gerardi</i>	July 28 1838	
<i>Angelica villosa</i>	Kalamazoo	
<i>Apios tuberosa</i>	September 5 (1837?)	
<i>Arenaria stricta</i>	Grand Prairie, July 2 1838	
<i>Arenaria stricta</i>	Grand Prairie, July 23 1838	
<i>Asclepias incarnata</i>	Kalamazoo, July 23 1838	
<i>Asclepias verticillata</i>	August 4 1838	
<i>Aster macrophyllus</i>	Kalamazoo	
<i>Athyrium thelypteroides</i>	July 27 1838	2 sheets
<i>Baptisia leucantha</i>	August 1 1838	
<i>Baptisia leucantha</i>	Grand Prairie, August 1 1838	
<i>Baptisia leucophaea</i>	Grand Prairie, August 1 1838	NY
<i>Boehmeria cylindrica</i>	Kalamazoo, July 26 1838	2 sheets
<i>Bouteloua curtipendula</i>	Grand Prairie, July 23 1838	2 sheets
<i>Bouteloua curtipendula</i>	July 23 1838	
<i>Buchnera americana</i>	August [28–31], 1837	
<i>Buchnera americana</i>	August 1837	
<i>Buchnera americana</i>	Kalamazoo, July 23 1838	2 sheets
<i>Cacalia atriplicifolia</i>	July 27 1838	
<i>Cacalia plantaginea</i>	Kalamazoo, in a marsh near a lake 3 mi. E of the village, July 25 1838	2 sheets
<i>Cardamine pratensis</i>	Kalamazoo, in small lake, August 1838	
<i>Carya amer?</i>	August 1838	
<i>Chelone glabra</i>	August 28	
<i>Chenopodium</i>	July 27 1838	
<i>Chenopodium botrys</i>	August 23 1838 (1837?)	
<i>Cladium mariscoides</i>	Kalamazoo, around small lakes, July 25 1838	
<i>Collinsia verna</i>	July 27 1838	NY
<i>Corallorhiza maculata</i>	July 31 1838	
<i>Coreopsis palmata</i>	Gull Prairie, August 1 1838	
<i>Coreopsis palmata</i>	Kalamazoo, July 23 1838	NY
<i>Desmodium bracteosum</i>	August 3 1838	
<i>Desmodium grandiflorum</i>	Kalamazoo, 1838	

(Continued)

APPENDIX I. (Continued)

Name	Label Data	Notes
<i>Desmodium nudiflorum</i>	Kalamazoo, July 26 1838	
<i>Desmodium paniculatum</i>	August 1 1838	
<i>Desmodium rotundifolium</i>	August 4 1838	
<i>Digitaria sanguinalis</i>		2 sheets
<i>Dioscorea villosa</i>	Kalamazoo, August 2 1838	
<i>Drosera rotundifolia</i>	Around Lakes, Kalamazoo, July 23 1838	
<i>Drosera rotundifolia</i>	Kalamazoo, around lakes July 25 1838	
<i>Dryopteris thelypteris</i>	Kalamazoo	
<i>Dulichium arundinaceum</i>	July 28 1838	
<i>Echinacea purpurea</i>	Gull Prairie, August 2 1838	
<i>Echinocystis lobata</i>	August 1838	
<i>Eleocharis equisetoides</i>	Sand Lake 1838	
<i>Elymus villosus</i>	[Kalamazoo] Michigan	
<i>Elymus villosus</i>	Kalamazoo, July 24 1838	2 sheets
<i>Eragrostis hypnoides</i>	Kalamazoo, July 20 1838	2 sheets
<i>Euonymus americana</i>	Along River	
<i>Euonymus americana</i>	July 23 1838	
<i>Euonymus americana</i>	Kalamazoo, July 24 1838	
<i>Euonymus obovatus</i>	Kalamazoo	
<i>Eupatorium perfoliatum</i>	August 3 1838	
<i>Gnaphalium uliginosum</i>	August 28 (1837?)	
<i>Goodyera pubescens</i>	July 31 1838	
<i>Habenaria ciliaris</i>	Austin's Lake, July 30 1838	
<i>Habenaria ciliaris</i>	Austin's Well, July 30 1838	
<i>Habenaria leucophaea</i>	1838	NY
<i>Habenaria psycodes</i>	Kalamazoo, July 25 1838	
<i>Habenaria psycodes</i>	Kalamazoo, July 26 1838	
<i>Habenaria tridentata</i>	Austin's Lake, Kalamazoo, July 1838	
<i>Hackelia virginiana</i>	July 27 1838	
<i>Helianthus divaricatus</i>	Kalamazoo, July 24 1838	
<i>Helianthus giganteus</i>	Kalamazoo	
<i>Hemicarpha micrantha</i>	Austin's Lake, July 30 1838	2 sheets
<i>Hemicarpha micrantha</i>	July 30 1838	
<i>Hippuris vulgaris</i>	July 23?–August 7 1838	
<i>Hippuris vulgaris</i>	Kalamazoo, July 28, 1838	
<i>Hydrocotyle umbellata</i>	Kalamazoo, 1838	
<i>Hydrophyllum</i>		
<i>appendiculatum</i>	July 31 1838	
<i>Hypericum ascyron</i>	July 31 1838	
<i>Hypericum prolificum</i>	Kalamazoo, 1838	
<i>Hypericum punctatum</i>	Kalamazoo, July 24 1838	
<i>Hystrix patula</i>	July 24 1838	
<i>Impatiens biflora</i>	Kalamazoo, ditches, July 25 1838	
<i>Juncus acuminatus</i>	July 28 1838	2 sheets
<i>Juncus marginatus</i>	September 1 1837?	
<i>Lechea major</i>	Kalamazoo, August 1838	
<i>Lechea villosa</i>	August 4 1838	
<i>Lemna minor</i>	Gull Lake, August 1838	
<i>Linum sulcatum</i>	August 1 1838	NY
<i>Linum sulcatum</i>	Grand Prairie, July 23 1838	
<i>Lobelia cardinalis</i>	Kalamazoo, margin of river, July 23 1838	
<i>Lobelia kalmii</i>	July 27 1838	
<i>Lobelia kalmii</i>	Kalamazoo, July 25 1838	
<i>Lycopus virginicus</i>	Gull Lake, August 2 1838	

Name	Label Data	Notes
<i>Lysimachia ciliata</i>	Kalamazoo, July 26 1838	
<i>Nyssa sylvatica</i>	Near Austin's Lake, August 1838	
<i>Panax quinquefolius</i>	Kalamazoo, July 1838	
<i>Panicum latifolium</i>	August 7 1838	
<i>Panicum virgatum</i>	July 28 1838	2 sheets
<i>Parnassia glauca</i>	Kalamazoo, July 25 1838	2 sheets
<i>Paronychia canadensis</i>	August 1 1837 (changed to 1838)	
<i>Phytolacca decandra</i>	July 27 1838	
<i>Polygonum buxiforme</i>	August 5 1838	
<i>Polymnia canadensis</i>	August 3 1838	
<i>Potamogeton pectinatus</i>	Grand Prairie, August 2 1838	
<i>Potamogeton pectinatus</i>	Gull Lake, Kalamazoo, August 1838	
<i>Potamogeton pectinatus</i>	Gull Prairie Lake, August 2 1838	
<i>Pycnanthemum virginianum</i>	Kalamazoo, July 24 1838	
<i>Pyrola secunda</i>	July 31 1838	
<i>Rhus copallina</i>	Austin's Lake, Kalamazoo, July 1838	
<i>Rhynchospora alba</i>	Kalamazoo, around small lakes, July 25 1838	
<i>Sabatia angularis</i>	Austin's Lake, July 30 1838	
<i>Sagittaria graminea</i>	Austin's Lake, July 20 1838 [July 30]	
<i>Satureja acinos</i>	August 1838	
<i>Scirpus cyperinus</i>	July 30 1838	
<i>Scleria lindleyana</i>	July 28 1838	
<i>Scleria lindleyana</i>	Small Lakes, July 28 1838	
<i>Scleria triglomerata</i>	Grand Prairie, July 23 1838	
<i>Silphium integrifolium</i>	Gull Prairie, August 2 1838	
<i>Sparganium chlorocarpum</i>	Kalamazoo, August 2 1838	
<i>Spirea alba</i>	July 28 1838	
<i>Stachys hyssopifolia</i>	July 30 1838	
<i>Taraxacum officinale</i>	July 27 1838	
<i>Thaspium trifoliatum</i>	July 23?–August 7 1838	
<i>Thaspium trifoliatum</i>	Kalamazoo	
<i>Tradescantia virginiana</i>	August 1838	
<i>Triglochin palustris</i>	Kalamazoo, July 1838	
<i>Triglochin palustris</i>	Kalamazoo, Marsh around small lake July 25 1838	
<i>Urtica gracilis</i>	Kalamazoo, July 25 1838	
<i>Utricularia gibba</i>	Kalamazoo, July 1838	
<i>Utricularia purpurea</i>	Austin's Lake, Kalamazoo, July 1838	
<i>Viola canadensis</i>	July 27 1838	
<i>Xyris caroliniana</i>	Austin's Lake, August 1838	
<i>Zigadenus glaucus</i>	July 28 1838	

APPENDIX II. Hanes & Rapp Collection Sites & Herbarium Notes.

Below I have provided USGS Topographic Map data to better locate some of the collection sites listed on Hanes & Rapp herbarium specimens at WMU and in the Haneses' flora. These sites were located with the help of information on herbarium labels, notes left by the Haneses and F. W. Rapp, property records, publications, manuscripts, and my own field experience and familiarity with the Kalamazoo County landscape. Many F. W. Rapp locality data were originally provided by R. W. Pippen in the form of notes taken during an interview with Rapp (Hultmark 1982; Snow 1958). In parentheses under the heading "Site Descriptors," I have provided additional notes when warranted. The Haneses and F. W. Rapp generally reported distances from their respective former homes on herbarium labels. The first name given on specimens in the Hanes herbarium is the location where the mounted specimen was collected. Many specimens bear additional label data referring to other localities in the county where a plant was known to occur. An annotation bearing the name Becker-Hanes means that Herbert R. Becker showed the Haneses where the plant was growing. An annotation reading "Herbert R. Becker" means that Becker gave the specimen to the Haneses. A small part of the Rapp collection is housed at the Kalamazoo Nature Center. Otherwise, most Hanes & Rapp specimens are housed at the WMU Hanes herbarium. Several sites listed here remain to be definitively relocated. They are included here in the hope that someday someone will take the time to further pinpoint their location. The task of relocating these sites was made more difficult by the apparent loss of a plat map used by the Haneses that used to be housed at WMU.

Site Descriptors (Hanes/Rapp)	USGS Topographic Map Location	Notes
Adam's Estate 1.5 mi. S of Vicksburg (Rapp)	T4S R11W SE¼ S25	On 24 th St.
Alamo Hill (Hanes)	T1S R12W on line between S27 & S28	1 mi. S of Alamo: 6 th St. climbs this hill
Andrew's bridge on old Hwy 131 (Hanes, Rapp)	T4S R11W N¼ NE¼ NE¼ S5	Now Shaver Rd. at its intersection with the Sugarloaf Lake flooding
Andrew's Creek (Hanes, Rapp)	T4S R11W N¼ S4 & N¼ S5 & T3S R11W SW¼ SE¼ S33	Where Shaver Rd. passes the Sugarloaf Lake flooding
Balch Creek (Rapp)	T2S R11W S¼	Actually Portage Creek*
Barley Motors (Hanes)	T4S R11W N¼ S5 & N¼ S4 extending into S3 & S-Central edge of S33	E of where Shaver Rd. passes through the Sugarloaf Lake flooding
Bear Creek* (Rapp)	T4S R10W S22 (for Brown Creek*)	Rapp usually means Brown Creek* 4 mi. SE of Vicksburg. Bear Creek* is found further W
Bear Creek* at Andres (Rapp)	T4S R10W S22	Woods on the E side of Brown Creek* on 31 st St.
Beaver Dam (Hanes)	T4S R11W N¼ S5	Near intersection of the drain out of Sugarloaf Lake & Oakland Dr.
Beech Loaf Island (Hanes)	T3S R11W Center S½ S31	See Fox Island
Bunker Hill (Hanes)	T3S R11W NE¼ S31	A small hill N of Sugarloaf Lake
Campbell Lake (Hanes)		Long Lake, Comstock Tp.

Site Descriptors (Hanes/Rapp)	USGS Topographic Map Location	Notes
Cement Bridge 1.25 mi. S of Vicksburg (Rapp)	T4S R10W S30	Kimble Creek bridge on 24 th St.
Bruce Chamberlain Farm (Hanes)	T4S R11W S11	Near Portage Rd. & U Ave. on the E of the Road
Clarks Orchard 1 mi. SE of Vicksburg (Rapp)	T4S R10W S19	On an old road (now closed) W of Uptegrove Lake
Cobb School (Hanes)	T4S R11W S edge S5	N side of U Ave. E of 14th St.
Cold Springs (Hanes)	T1S R12W NW $\frac{1}{4}$ S24	2 mi. E of Alamo
Cooley's Farm (Rapp)	T4S R11W S $\frac{1}{2}$ NW $\frac{1}{4}$ S24	S side of the Vicksburg Creek S of the Cemetery
Crane Town (Hanes)	In a strict sense limited to T4S R12W S20	Sometimes used in a strict sense to include only an island of 3 or 4 acres a short distance N of the Pleasant Valley Church. In a larger sense it takes in all of the marshy land around Flowerfield Creek in Prairie Ronde Tp.
Creeks emptying into Mud Lake (Rapp)	T3S R11W SE $\frac{1}{4}$ NE $\frac{1}{4}$ S31 & T3S R11W SW $\frac{1}{4}$ NW $\frac{1}{4}$ S32	
Davis Woods (Hanes)	T4S R12W N $\frac{1}{2}$ S $\frac{1}{2}$ S23	
Drake School (Hanes)	T2S R11W S19	N side of Michigan Ave. E of Drake Rd.
Bert Duncan Farm (Hanes)	T4S R12W probably N $\frac{1}{2}$ SE $\frac{1}{4}$ S36	SW of Schoolcraft near Flowerfield Creek
E of Little Portage Creek * (Rapp)	T4S R10W W $\frac{1}{2}$ S21	Portage River* 2.5 mi. E of Vicksburg & .5 mi. S on the E side of the road
Fanckboner School (Hanes)	T4S R12W S14	SW corner of VW Ave. & 10th St.
Field W of No. 8 School (Hanes)	T4S R12W school lies at the extreme SW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of S16	
Fox & Beers Millpond (Hanes)	T4S R12W N $\frac{1}{2}$ SE $\frac{1}{4}$ S26	
Fox Island (Hanes)	T3S R11W Center S $\frac{1}{2}$ S31	Immediately W of Sugarloaf Lake, N of Sugarloaf Island
Fruit Belt Railway Texas Tp. (Hanes)	T3S R12W parts of S4, S5, S7, S8, & S18	
Fulton's Marsh (Hanes, Rapp)	T4S R11W S14	Between W Ave. & VW Ave. N of GTRR. Fulton's Marsh was adjacent to & continuous with Hettingas Marsh. The names reflect the 2 owners.

(Continued)

APPENDIX II. (Continued)

Site Descriptors (Hanes/Rapp)	USGS Topographic Map Location	Notes
Frank Gilchrist Woods (Hanes)	T4S R 12W probably NE¼ NE¼ S35	
Godshalk Addition (Hanes, Rapp)	T4S R10W S19	SE of intersection of W Ave. & 24 th St.
GTRR near "Spring Run" (Spring Run) (Hanes)	T4S R11W S14	
Guilford Marsh (Hanes)	T4S R12W N½ NW¼ S33	5 mi. W of Schoolcraft near the GTRR
Hanes-Bartholomew Farms (Hanes)	T4S R11W SW¼ S22	
Hanner (Frank) Farm (Frank Hanner's) (Hanes)	T3S R12W NE¼ S25	NE of Weeds Lake
Harper's Woods (Hanes)	T4S R10W probably N½ NE¼ S35	Near the intersection of XY Ave. & 32 nd St.
Harrington Marsh (Rapp)	T4S R11W W½ SW¼ S24	W of the junction of X Ave. & 22 nd St. NE of Barton Lake
Harrison Cemetery (Hanes)	T4S R12W W edge NW¼ NW¼ S12	
Hermann's Farm (Hanes)	T4S R10W S11	Vicinity of U Ave. & 32 nd St.
High wooded ridges in Charleston Township (Hanes)	T2S R9W S15	3.5 mi. E of Galesburg
Holcomb Woods (Hanes, Rapp)	T4S R9W E½ SE½ S30	2.5 mi. SW of Fulton, S of creek
Indian Fields (Hanes)	T2S R11W S-Central edge S2	
Island Marsh (Hanes)	T4S R11W SW¼ SW¼ S18,	W of Schoolcraft N of W Ave. in the "Island" woods
Island Woods (Hanes)	T4S R11W SW¼ SW¼ S18	Immediately W of Schoolcraft mostly on the N side of W Ave.
Jas. Budrow Farm & Marsh; Jas. Budrow Muck Farm; Budrow Farm (Hanes)	T4S R11W E½ NE¼ S5, S of Andrew's Creek	S & E of the Sugarloaf Lakes
Jenkinson School (Hanes)	T4S R10W SW¼ SE¼ S17	N side of intersection of W Ave. & 27 th St.
Kealey (Hanes)	T2S R10W S edge SW¼ S8	
Kerns Crossing (Hanes)	T4S R10W S edge of S7	GTRR crossing E of Sprinkle Rd. on V Ave.
Bessie Knight Woods (Hanes)	T4S R12W probably N½ S30	

Site Descriptors (Hanes/Rapp)	USGS Topographic Map Location	Notes
Krum Marsh (Hanes)	T4S R11W SE¼ NW¼ S19	W of old grain elevator at Schoolcraft
LeFevre Bog (Hanes, Rapp)	T3S R9W Center of SE ¼ S8	
Levi Luce Farm (Hanes)	T4S R12W S1 probably S½ SW¼	
Lost Island Marsh (Hanes)	T4S R11W on line between S18 & S19	E side of the village of Schoolcraft
Lost Island School (Hanes)	T4S R11W SE¼ SE¼ S17	NW corner of W Ave. & 16th St.
Marsh 4 mi. NE (Rapp)	T4S R10W S9	W of 29 th St. between the creek & the Road
Marsh near school (Rapp)	T4S R10W S18	In Vicksburg City on W Ave.
Moist Woods Hetrick's Bridge (Rapp)	T4S R10W SW¼ S28	Y Ave. at the Portage River*
Moyers Corner (Rapp)	T4S R10W E½ S28	Corner of XY Ave. & 30 th St.
Mud Hole (Rapp)	T4S R11W middle of E½ S25 & T4S R10W N½ S30	A small pond E of Kimble Lake on Portage Creek & a part of the outlet to this lake.
Mud Lake Portage Tp. (Hanes)	T3S R11W SE¼ NE¼ S31 & now T3S R11W SW¼ NW¼ S32 (has increased in size)	N of the Sugarloaf Lakes in the Gourdneck State Game Area
Munn Marsh (Rapp)	T4S R10W S16	Near 29 th St. & V Ave. A fence separated Clarks Marsh (E side of fence) from Munn Marsh (W side).
Near McKain's Corners 6 mi. NE (Rapp)	T3S R10W S36	McKain's Corners is the extreme NW corner of S36. It lies at the intersection of S Ave. & 34 th St.
Near Sugarloaf Lake along the Railway (Hanes)	T4S R11W N½ S5	
Neasmith RR Crossing (Hanes, Rapp)	T4S R11W on line between S14 & S23. Neasmith owned the property to the S of this line.	Where GTRR crosses W Ave. 4 mi. E of Schoolcraft
Nesbitt Wood (Hanes)	T3S R12W SE¼ SE¼ S33	
Nichols Farm 5 mi. SE (Hanes)	T4S R10W S34	
No. 8 School (Hanes)	T3S R11W SW¼ NE¼ NE¼ S32	

(Continued)

APPENDIX II. (Continued)

Site Descriptors (Hanes/Rapp)	USGS Topographic Map Location	Notes
Oak Grove School (Hanes)	T1S R12W S23	W of Ravine Rd. near intersection with Owen Dr.
Old Churchyard 5 mi. SE (Rapp)	T4S R10W W-central edge S34	31 st St. at YZ Ave.
Osborn Farm (Hanes)	T3S R11W N $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ S32 & N $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ S32	N of Sugarloaf Lake & W of Shaver Rd.
Oswalt Marsh (Simmons Marsh; Oswalt bought the property from Simmons) (Rapp)	T4S R10W Center S19 (probably NE $\frac{1}{4}$ SW $\frac{1}{4}$)	SE of Frazer's Grove
Outlet of Barton Lake (Rapp)	T4S R11W S26	
Outlet of the two Mud Lakes (Hanes)	T1S R12W N $\frac{1}{2}$ S22 & NW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ S22	Small creek SE of Alamo
Patton's Marsh (Hanes)	T4S R12W at the center of the S edge of S12	
Pleasant Valley School (Hanes)	T4S R12W SE $\frac{1}{4}$ S29	E side of 3rd St. between XY Ave. & Y Ave.
Philip Porter Farm (Hanes)	T4S R12W E $\frac{1}{2}$ S20	5 mi. W of Schoolcraft on S side of Road, E of Flowerfield Creek
Portage Lake (Hanes)		The name Portage Lake used on some USGS topo maps is actually a group of three lakes in Section 34 Comstock Tp. that the Haneses often break up into their individual names of Blue, Long, and Portage Lakes
Prairie Grove School (Hanes)	T4S R11W Center S27	S side of junction of XY Ave. & Barton Lake Rd.
Prudential Nursery (Rapp)	T4S R11W S13 & T4S R10W S18	The current site of the Prudential Nursery in Vicksburg
Rapp House (Rapp)	T4S R10W S19	213 E Highway St. (W Ave.) Vicksburg
Rapp's Woods (Rapp)	T4S R10W NE $\frac{1}{4}$ S24	SW corner of the intersection of W Ave. & 36 th St.
Raynor's Woods (also misspelled Rayner) (Hanes, Rapp)	T4S R10W E $\frac{1}{2}$ W $\frac{1}{2}$ S35	
Frank Reeds (Hanes)	T4S R11W S13	Vicksburg 2 blocks W of the Rapp home on Highway St. (W Ave.)
Frank Reeds Marsh (Hanes)	T4S R11W S13	On Highway St. (W Ave.) just S of the RR right-of-way
Rix School (Hanes)	T3S R12W S5	NW corner of O Ave. & 4th St.

Site Descriptors (Hanes/Rapp)	USGS Topographic Map Location	Notes
School No. 8 Portage Tp. (Hanes)	T3S R11W S32	E side of Oakland Dr. N of Osterhout Rd.
Albert E. Schumann Farm (Hanes)	T4S R11W S17	On the N side of VW Ave.
Grant & Bruce Schutes Land (Hanes)	T4S R12W SE¼ S20 & SW¼ SW¼ S21	
S16 School (Prairie Ronde Tp.)	T4S R12W S16	W side of 5th St. at VW Ave.
Shaffer's Woods (Hanes)	T4S R11W N½ S34	NE of Goose Lake
Small Creek NW of Sugarloaf Lake (Hanes)	T3S R11W E½ S31	
Reuben Smith's Woods (Hanes)	T4S R12W probably NW¼ S25	3 mi. SW of Schoolcraft
<i>Sphagnum</i> bog West Lake (Hanes)	T3S R11W E½ SW¼ SW¼ S22	W end of West Lake
Spring Brook (Hanes)	T1S R10W S19	Small stream emptying into the Kalamazoo River. Most collecting was done in Section 19
Spring Brook School (Hanes)	T1S R10W S9	N side of M-89 about ½ mi. E of 28th St.
Spring Run (Hanes)	T4S R11W S14	Small stream that runs through Fulton's Marsh & crosses VW Ave.
Stockyard (Rapp)	T4S R10W S7	NE side of Vicksburg on GTRR
Stream connecting the two Sugarloaf Lakes (Hanes)	T3S R11W S½ S31	
Sugarloaf Island (Hanes)	T3S R11W S31	Take Sugar Isle Dr. to Higley Circle which circles Sugarloaf Island
Sugarlot (Hanes)	See "Island Woods" (Hanes)	
Texas Corners (Hanes)	T3S R12W intersection of S14, S15, S22 & S23	Intersection of 8 th St. & Q Ave.
M. P. Thomas Farm Marsh (Hanes, Rapp)	T4S R12W Center of N½ SW¼ S24	
Toad Hollow School (Hanes)	T2S R9W S32	N side of MN Ave. between 38th St. & 39th St.
Towers School (Hanes)	T3S R12W SE¼ SE¼ S22	NW corner of R Ave. & 8th St.
Vicksburg 2.5 mi. E; S to end of Road, W along fence (Rapp)	T4S R10W S21	Where 29 th St. turns E
Vicksburg Creek (Rapp)	T4S R11W S24	Creek that runs through Vicksburg
Vicksburg Drain (Rapp)	T4S R10W S18	E of RR right-of-way

(Continued)

APPENDIX II. (Continued)

Site Descriptors (Hanes/Rapp)	USGS Topographic Map Location	Notes
Well's Woods (Hanes)	T3S R11W E½ SW¼ S31	N of Sugarloaf Lake
West Fork of Portage Creek* wooded streamside (Hanes)	T3S R11W NE¼ NE¼ S5	1 mi. S & a little W of Whites Lake
West of Fuller Crossing (Hanes, Rapp)	T4S R10W S30	Fuller Crossing is the RR crossing at Y Ave.
Westervelt Farm (Rapp)	T4S R10W S22	31 st St. S of Bear Creek*
Woods along Kalamazoo River E of Galesburg (Hanes)	T2S R9W parts of S8 & S9	Along N side of Kalamazoo River
Worthington Crossing (Hanes)	T4S R11W NE¼ S22	4 mi. E of Schoolcraft

*Rapp appears to have confused the Little Portage Creek with the Portage River, usually intending to refer to the latter. He also confused Bear Creek with Brown Creek, usually meaning to refer to the latter. This is a reasonable mistake because Bear Creek & Little Portage Creek are both found just a little further west.

APPENDIX III. Kalamazoo County Plant Communities.

Headings in caps indicate abbreviations used in the text of the annotated checklist. A classification is already available for Michigan (Albert 1995), but I present a slightly different version here that should better meet the needs of this flora. This classification incorporates local pre-European settlement and contemporary data with elements adapted from other sources. I have drawn much material from my field experience in Kalamazoo County. Numerous publications and unpublished reports have also been consulted in preparing this appendix. The following references were some of the most influential: Albert 1995; Albert 1990; Albert et al. 1986; Brewer et al. 1984a; Brewer et al. 1984b; Brewer et al. 1969; Chapman et al. 1989; Chapman 1984; Comer et al. 1997; Comer et al. 1995; Curtis 1959; Hodler et al. 1981; Kenoyer 1934; Kenoyer 1930; Pippen 1991. Pre-European settlement vegetation maps of Kalamazoo County accompany the description of each plant community. I have adapted these maps from previously published interpretations of the GLO surveys of 1826–1830, and I have incorporated some of my own observations (Brewer et al. 1984a; Comer et al. 1997; Comer & Albert 1995; and Hodler et al. 1981).

I have treated prairie and savanna plant communities in relatively more detail than most others (including photos) due to their former importance, present rarity (they are nearly extinct in Kalamazoo County), and their enigmatic natural history. I have also spent an inordinate amount of my time studying them.

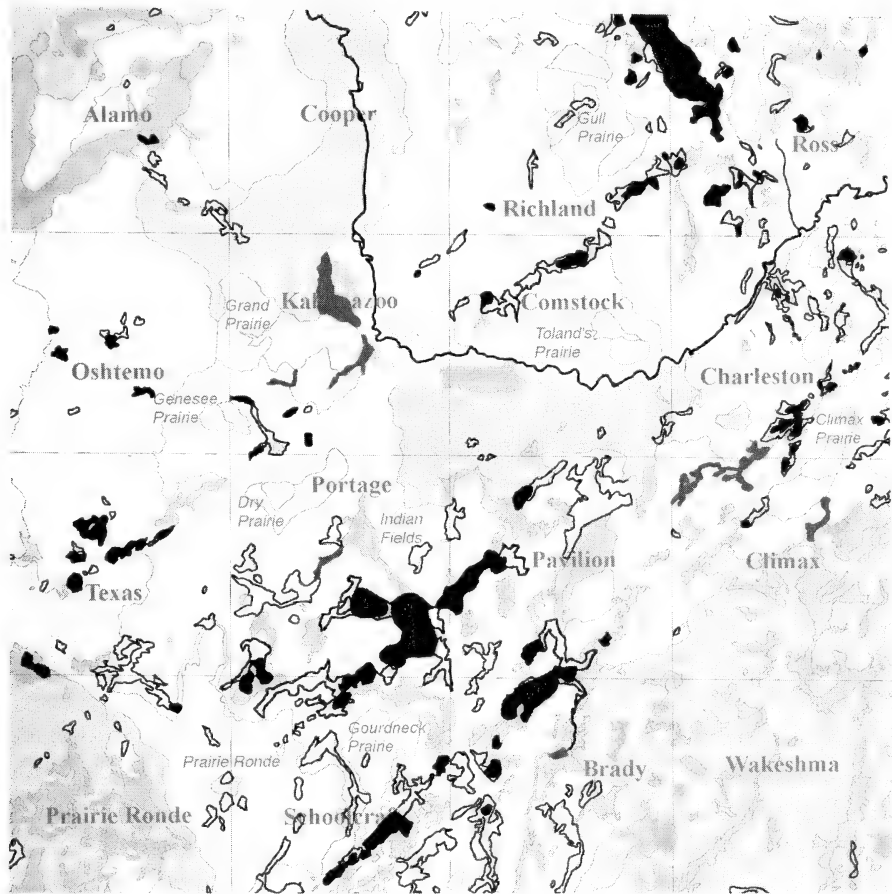


FIGURE 4. An interpretation of the GLO surveys of 1826–1830, showing the approximate presettlement distribution of lakes, the Kalamazoo River, wet prairie, and other open wetlands in Kalamazoo County. Map adapted from Comer & Albert (1995), Comer et al. (1997), Brewer et al. (1984a, 1984b), and Hodler et al. (1981).

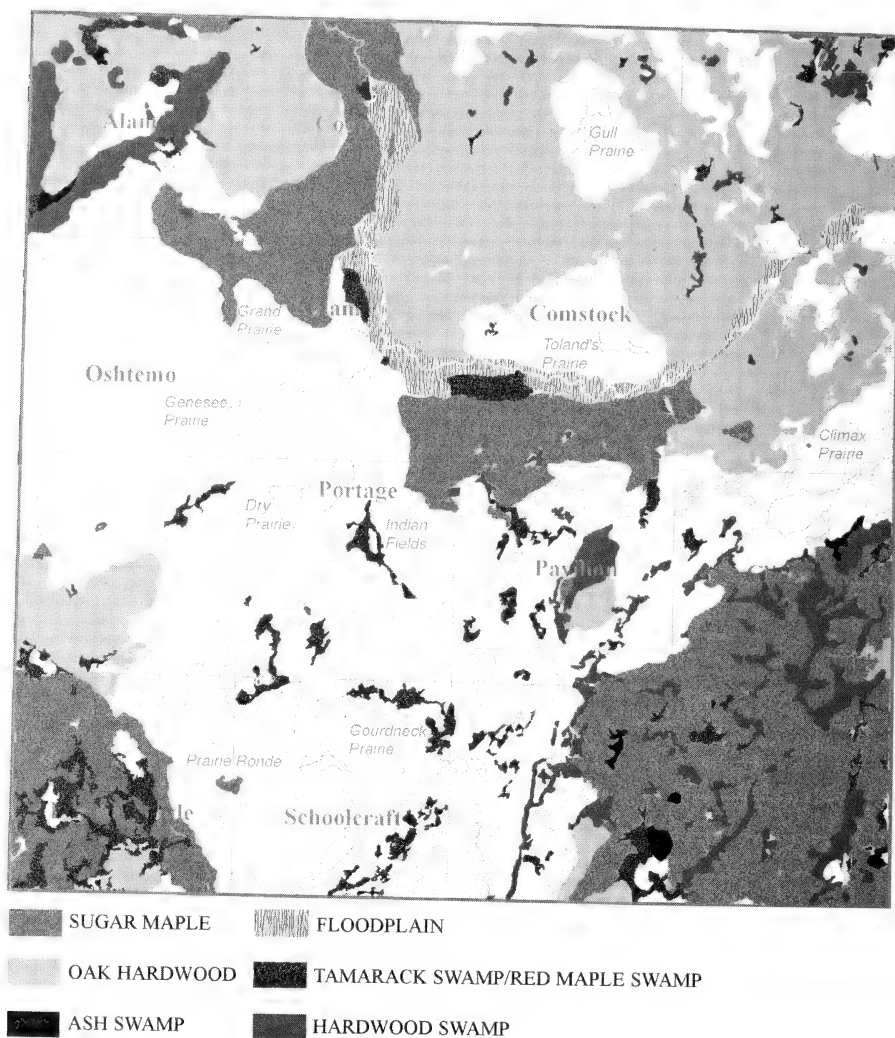
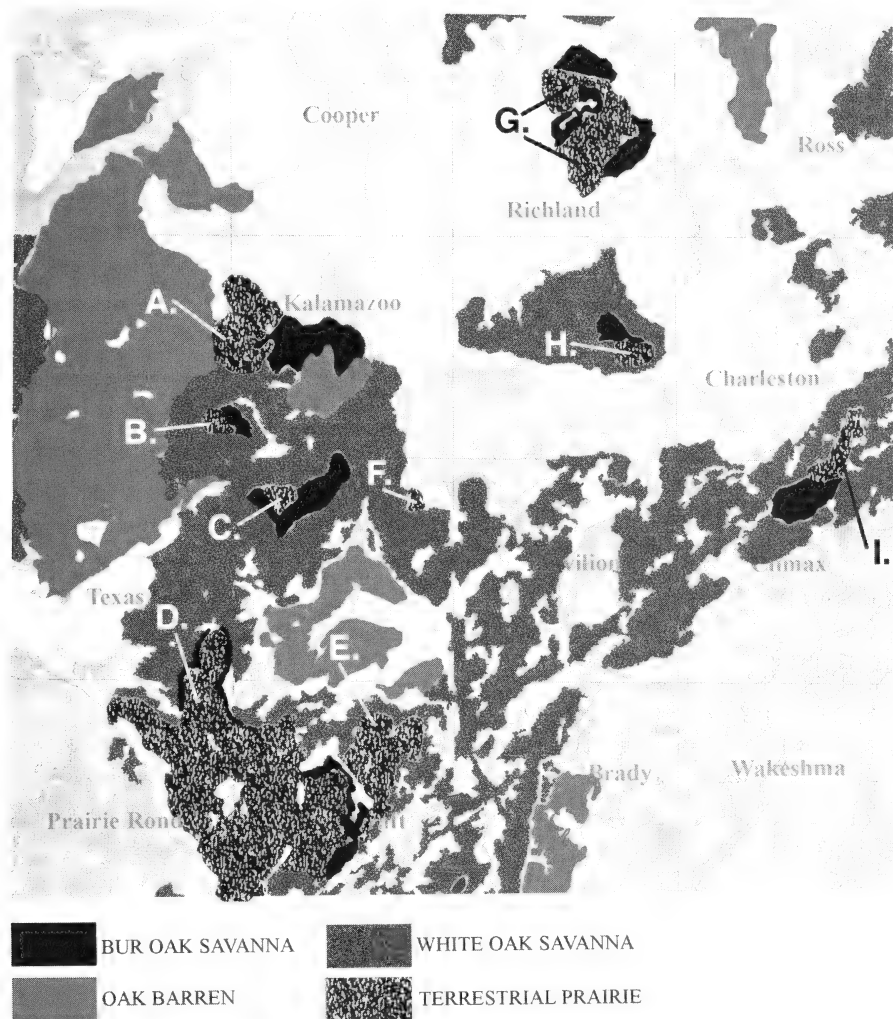


FIGURE 5. An interpretation of the GLO surveys of 1826-1830, showing the approximate presettlement distribution of forested wetlands and terrestrial forests. Mixed oak forest, which occurred only on the extreme W edge of Prairie Ronde Tp. is not shown. Wetlands dominated by white pine, which occurred only near the Sugarloaf Lakes and near Goose Lake, are probably best treated as a form of savanna resulting from fire in RED MAPLE SWAMP. It is not separated from TAMARACK SWAMP and RED MAPLE SWAMP on this map. Map adapted from Comer & Albert (1995), Comer et al. (1997), Brewer et al. (1984a, 1984b), and Hodler et al. (1981).



(A.) Grand Prairie, (B.) Genesee Prairie, (C.) Dry Prairie, (D.) Prairie Ronde, (E.) Gourdneck Prairie, (F.) Indian Fields, (G.) Gull Prairie, (H.) Toland's Prairie, (I.) Climax Prairie

FIGURE 6. An interpretation of the GLO surveys of 1826–1830, showing the approximate presettlement distribution of prairie and savanna. White pine dominated wetlands, which covered only a few acres near the Sugarloaf Lakes and S of Goose Lake is probably best treated as a form of savanna. It is shown on the previous map, but not separated from TAMARACK SWAMP and RED MAPLE SWAMP (see treatment of RED MAPLE SWAMP). Adapted from Comer & Albert (1995), Comer et al. (1997), Brewer et al. (1984a, 1984b), and Hodler et al. (1981).

Aquatic/Wetland

Open Aquatic/Wetland (Figure 4)

Submergent Marsh (SUB-MARSH). Submergent marsh often forms a dynamic interface with emergent marsh. Variations in the depth of water and substrate, disturbance history, and other factors provide for much variety in floristic composition. For utility, and despite evidence to the contrary, I do not formally recognize variants of submergent marsh. Some typical plants include *Ceratophyllum demersum*, *Elodea canadensis*, *Heteranthera dubia*, *Myriophyllum* spp., *Najas* spp., and *Potamogeton* spp.

Emergent Marsh (EM-MARSH). Emergent marsh is usually submerged for most of the year. It often forms a dynamic interface with submergent marsh. Some typical plants include *Eleocharis robbinsii*, *Glyceria borealis*, *Leersia oryzoides*, *Lemna minor*, *L. trisulca*, *Nuphar* spp., *Nymphaea* spp., *Phragmites australis*, *Polygonum* spp., *Pontederia cordata*, *Sagittaria latifolia*, *Scirpus acutus*, *S. fluviatilis*, *Sparganium* spp., *Typha latifolia*, *Utricularia* spp., and *Zizania aquatica*. For utility, and despite evidence to the contrary, I formally recognize only one variant of submergent marsh (coastal plain marsh) below and in the annotated checklist.

Remnant prairie wetlands harbor unique emergent marsh and submergent marsh communities not found elsewhere in the county. These marshes are dynamic, and in some years may dry up completely. This tendency has led to their demise since in low water years they are/were often grazed or plowed. Plants restricted, or nearly so, to relatively intact remnants of these wetlands include *Astragalus canadensis*, *Carex sartwellii*, *Eleocharis engelmannii*, and *Potentilla anserina*. Prairie wetlands may also harbor rare plants usually associated with coastal plain marshes such as *Rhynchospora macrostachya* and *Rotala ramosior*. Some examples of prairie wetlands include the Island Pond, Harrison Lake, Weeds Lake, the Lost Island Marsh, and Patton's Marsh, all of which occur on the former Prairie Ronde (in Prairie Ronde & Schoolcraft Tps.). There are numerous other smaller examples. A few of these may have potential as sites for palynological study of the little-known dynamics and natural history of Prairie Ronde and/or other of the former large terrestrial prairies.

Coastal Plain Marsh (COASTAL-PLAIN-MARSH) Figures 7–8. Coastal plain marsh is a variant of emergent marsh usually associated with sandy to peaty substrates of lakes and ponds with dynamic water levels. Coastal plain marsh is formally recognized here as distinct from other emergent marsh communities due to the many plants that are found nowhere else in Kalamazoo County. The name coastal plain marsh refers to the floristic similarity of these wetlands to marshes on the Atlantic Coastal Plain. Most coastal plain marshes are in the west half of the county. They are usually associated with sandy former black oak barrens.

Coastal plain marsh plant communities are dynamic and usually exhibit concentric zonation related to water level. Some typical plants from the sandy zone at the waters edge or in shallow water include *Carex scoparia*, *Eleocharis melanocarpa*, *Fuirena squarrosa*, *Hemicarpha micrantha*, *Juncus* spp.,



FIGURE 7. Coastal plain marsh with *Calamagrostis canadensis* and *Rhynchospora macrostachya* SW of Austin Lake (Portage Tp.) photographed in August 2002.



FIGURE 8. Sandy lakeshore (with native coastal plain marsh flora) at Pretty Lake (Texas Tp.) photographed in August 2002.

Rhynchospora macrostachya, *Sabatia angularis*, and *Euthamia remota*. Other plants, including *Calamagrostis canadensis*, and *Eupatorium perfoliatum*, are more common where the substrate is slightly drier, and plants such as *Cephalanthus occidentalis*, and *Spiraea tomentosa*, are usually limited to the relatively dry margin of the marsh (Brodowicz 1989; Fernald 1942; Hanes 1942; Peattie 1922; Pierce 1974; Reznicek 1994). Relatively undisturbed sandy lakeshores, but without significant areas of marsh, often support coastal plain marsh plant communities. Coastal plain marsh communities are home to some of the rarest plants in Kalamazoo County and in Michigan.

Several Kalamazoo County plants are known only from coastal plain marsh and other sandy/peaty lakeshores, among these are *Carex viridula*, *Eleocharis melanocarpa*, *Euthamia remota*, *Fuirena squarrosa*, *Hemicarpha micrantha*, *Lycopodiella inundata*, *Polygala cruciata*, *Psilocarya scirpoides*, *Rhexia virginica*, *Sabatia angularis*, *Utricularia purpurea*, and *Xyris torta*. Increasing recreational pressure and further development of sandy lakeshores, including artificial stabilization of water levels (especially in Texas and Portage Tps.), do not bode well for the future of these unique and globally rare wetlands.

Wet Meadow (WET-MEADOW). Wet meadow is usually located along streams and in stream valleys, along lake margins, and in other depressions. Soils are usually saturated, mucky, and poorly drained. Floristic composition varies greatly depending on substrate pH and texture, drainage, fire history, water level, and other factors. Sedges and grasses dominate. Some typical plants today include *Angelica atropurpurea*, *Asclepias incarnata*, *Calamagrostis canadensis*, *Carex aquatilis*, *C. bebbii*, *C. lacustris*, *C. lanuginosa*, *C. stricta*, *Eupatorium maculatum*, *Helianthus giganteus*, *Phalaris arundinacea* (especially after grazing), *Potentilla fruticosa*, *Solidago patula*, *Spartina pectinata*, *Spiraea tomentosa*, *Thalictrum dasycarpum*, *Thelypteris palustris*, and *Typha latifolia*. Wet meadow superficially resembles wet prairie. Fire was once a component of wet meadow ecology and probably helped maintain their open character. Today, shrubs have invaded large areas of former wet meadow. Unplowed and otherwise relatively undisturbed wet meadow communities occur throughout the county, but some of the largest, least altered, and the most floristically rich, are concentrated in Prairie Ronde Tp. along the course of Flowerfield Creek. While not formally recognized or elaborated upon here, several distinctive variants of wet meadow occur in Kalamazoo County.

Bog (BOG) Figure 9. Bog is something of a catch-all category for peatlands with a *Sphagnum* or *Sphagnum* and sedge substrate greater than about 30 cm thick (Crum 1988). For utility, and despite evidence to the contrary, I have grouped all of these bog-like wetlands under one name. Hydrology and nutrient levels, pH, and fire history, are some important factors affecting floristic composition. Mosses (*Sphagnum* spp. & rarely *Polytrichum*) are very important. In our area, bog is sometimes called bog relict.

Bogs are usually composed of a dynamic mosaic of several distinct, successional-related plant communities. These usually include *Sphagnum* sedge mat, bog meadow, shrub carr, tamarack swamp forest, inundated shrub swamp, and



FIGURE 9. Aerial photograph of LeFevre Bog, Climax Tp. (photo courtesy of Clayton Alway). This lacustrine fringe bog is unique in Kalamazoo County in having a floating "mat" of vegetation that entirely encircles the "eye" of the bog (a classic "kettle-bog"). This photo was taken in summer 1981. Since then, a fishing pond has been built near the bog, and fill has been dumped onto part of the bog mat.

red maple swamp forest (locally). Only shrub carr, tamarack swamp forest, inundated shrub swamp, and red maple swamp forest, are further treated separately since significant remnants of these communities exist outside of bogs in Kalamazoo County.

The *Sphagnum* sedge mat usually occurs near open water and is quite wet. Some typical plants include *Calopogon tuberosus*, *Carex lasiocarpa*, *Decodon verticillatus*, *Drosera rotundifolia*, *Liparis loeselli*, *Sarracenia purpurea*, *Vaccinium oxycoccus*, and *Xyris difformis*.

Bog meadow is closely allied to the *Sphagnum* sedge mat, but is usually not as wet or species-rich. Some typical plants include *Carex limosa*, *C. oligosperma*, *Chamaedaphne calyculata*, *Cypripedium acaule*, *Larix laricina*, *Platanthera ciliaris*, *Pogonia ophioglossoides*, *Rhynchospora alba*, *Toxicodendron vernix*, *Vaccinium macrocarpon*, and *Woodwardia virginica* (Brewer 1966a; Keough & Phippen 1981; Swinehart & Parker 2000).

Acer rubrum, *Cornus amomum*, *Toxicodendron vernix*, and *Vaccinium* spp. are often locally abundant, especially in and near the bog moat (sometimes called the lagg) at the upland/wetland interface.

Areas within bog that are dominated by heavy shrub growth including such

species as *Cornus amomum*, *Rosa palustris*, and *Sambucus canadensis*, are sometimes called shrub-carr (see below).

Since few data are available describing the hydrology, patterning, nutrient status, pH, peat depth, and other characteristics of Kalamazoo County bogs, I do not recognize variants in the annotated checklist; however, at least three variants are apparent when one considers landscape position.

1. **Lacustrine fringe:** Occasional on the borders of more or less oligotrophic lakes and ponds. These bogs typically exhibit relatively high plant species richness and distinct zonation, often including a moat at the upland/wetland interface, a shrub and tamarack zone, and bog meadow and a sedge-*Sphagnum* floating mat adjacent to open water.
2. **Riverine fringe:** bordering a river or stream. Water characteristically flows through the acidic substrate. Several large and unusual bogs border Flowerfield Creek in Prairie Ronde Tp. near the intersections of YZ Ave. and 4th St., and YZ Ave. and 5th St. They are difficult to characterize because their floras are poorly-known, but they appear to exhibit low to moderate plant species richness relative to other bog variants.
3. **Seepage:** Bog sometimes intergrades with fen along lakeshores in Kalamazoo County, probably owing to local variations in water and mineral input, water levels, and peat accumulation. These patchy wetlands are usually located at the margins of mildly eutrophic lakes. Portions of these complex wetlands are often dominated by shrub carr, characteristically including *Betula pumila*, and invasive exotics and aggressive natives such as *Lythrum salicaria*, *Phragmites australis*, and *Typha* spp. (probably resulting at least in part from hydrologic manipulation, fire suppression, and eutrophication). Despite the often heavy growth of shrub carr, they are usually quite species rich. A few nice examples of seepage bog occur in the Gourdneck State Game Area (Gourdneck SGA).

Bishop's Bog (approximately 70 acres in section 28 of Portage Tp.) is close to what some classifications call poor fen but probably is closest to lacustrine fringe bog in the above classification despite the numerous ways in which it differs from other members of this class. It appears to have been subject to occasional fires owing to the fire damaged trunks of tamarack scattered throughout the bog.

Fen (FEN) Figures 10–11. Fen is usually characterized by having groundwater rich in magnesium and calcium flowing from springs and percolating through the organic muck, marl, and/or sedge peat substrate. Many Kalamazoo County fens are located in outwash alongside lakes and streams. Fens are usually composed of a mosaic of several successional-related plant communities including fen meadow, shrub carr, fen sedge meadow, and tamarack swamp (only shrub carr and tamarack swamp are treated separately below and in the annotated checklist) (Albert & Comer 1999).

Fen sedge meadow usually occurs in wet depressions near lake or stream margins and springs. Some typical plants include *Arnoglossum plantagineum*,



FIGURE 10. Fen sedge meadow at Paw Paw Lake (Texas Tp.) dominated by *Arnoglossum plantagineum* (white flowers), just as it was more than 50 years ago when admired by the Haneses (R. W. Pippen pers. comm. 1996). Photographed in early July.

Calopogon tuberosus, *Carex buxbaumii*, *C. lasiocarpa*, *C. prairea*, *Cladium marsicoides*, *Eleocharis rostellata*, *Liatris spicata*, *Liparis loeselii*, *Lobelia kalmii*, *Parnassia glauca*, *Platanthera dilatata*, *Potentilla palustris*, *Sarracenia purpurea*, *Scirpus acutus*, *Tofieldia glutinosa*, *Triglochin maritimum*, and *Utricularia intermedia*.

Fen meadow is closely allied to sedge meadow, but is not as wet. Some typical plants of fen meadow include *Calamagrostis canadensis*, *Carex aquatilis*, *C. stricta*, *Cypripedium candidum*, *Phalaris arundinacea*, *Potentilla fruticosa*, *Saxifraga pensylvanica*, *Valeriana uliginosa*, and sometimes prairie grasses and forbs such as *Andropogon gerardii*, *A. scoparius*, *Panicum virgatum*, *Silphium integrifolium*, *Sorghastrum nutans*, *Spartina pectinata*, *Sporobolus heterolepis*, *Veronicastrum virginicum*, and others. Most Kalamazoo County fens can be accurately called "prairie fens" since they exhibit significant tallgrass prairie floras (Penskar & Higman 2000; Sytsma & Pippen 1981a, 1981b, 1982a, 1982b, 1982c).

Areas dominated by shrub growth are usually called shrub carr (see separate treatment for shrub carr). Areas with tree growth are usually dominated by tamarack and may occasionally be densely wooded enough to be called tamarack swamp forest. Several distinctive variants of fen occur in Kalamazoo County but are not elaborated here.

Fens are the most species-rich plant communities remaining in Kalamazoo County, and are the only relatively intact plant community in which several



FIGURE 11. Aerial view (summer 1981) of a prairie fen at Hogset Lake in the Gourdneck SGA (Schoolcraft Tp.) (photo courtesy of Clayton Alway). Notice how shrubs and trees have colonized the slightly drier rises in the fen meadow at the bottom of the photo, replacing plants such as *Cypripedium candidum* and *Potentilla fruticosa* which were once common here (Hanes & Hanes 1947; pers. obs.). Much additional shrub growth has occurred at this site since this photograph was taken. The fen sedge meadow which is very clearly seen in the top center of this picture is now almost completely covered in shrubb-carr (pers. obs. 1996–1997).

former prairie plants persist. Fens occasionally contain local concentrations of bog plants (such as *Pogonia ophioglossoides* and *Vaccinium* spp.) due to local variation in substrate conditions, and can intergrade with seepage bog which characteristically contains local concentrations of fen plants (see bog). Fires were once an important factor affecting floristic composition and vegetation structure in fens (Albert & Comer 1999).

Wet Prairie (WET-PRAIRIE) Figures 12–13. Wet prairie characteristically occurred in shallow depressions, usually near streams, on seasonally inundated, level, saturated loam, silt loam, or rarely muck, with variable pH. Fire was once an important natural process. The one relatively intact site from which data are available (no longer extant) may have been close to wet-mesic in nature since it included many more prairie plants than some other extant and wetter (but more disturbed) sites (Brewer 1965). Some plants found in the aforementioned former relatively intact remnant, and in other remnants include *Andropogon gerardii*, *Apios americana*, *Apocynum cannabinum*, *Aster novae-angliae*, *A. oolentangiensis*, *A. sagittifolius*, *Calamagrostis canadensis*, *Carex bebbii*, *Cicuta maculata*, *Cirsium muticum*, *Comandra umbellata*, *Coreopsis tripteris*, *Eryngium yuccifolium*, *Eupatorium maculatum*, *Cornus racemosa*, *Equisetum arvense*, *Fragaria virginiana*, *Galium boreale*, *Gentiana andrewsii*, *Geranium macula-*



FIGURE 12. Disturbed streamside wet and wet-mesic prairie in Schoolcraft Tp. photographed in August.



FIGURE 13. Close-up of relatively intact and unplowed wet prairie/bur oak savanna (perhaps wet-mesic) ground cover within the right-of-way of the former MI Central RR near the WMU campus and Stadium Drive. This prairie was mostly covered by fill from 1962–1964 during the relocation and improvement of part of Stadium Drive (see Brewer 1965). Most of the remaining prairie has since been overgrown by shrubs and trees. Nothing like it remains in Kalamazoo County. This photograph was published in Brewer (1965). It is possible to make out several prairie plants in the photo, including *Andropogon gerardii*, *Aster sagittifolius*, *Eryngium yuccifolium*, *Galium boreale*, and *Spartina pectinata*. Brewer (1965) provides a nice quantitative ecological analysis of the structure and composition of this former prairie.

tum, *Helianthus decapetalus*, *Heuchera richardsonii*, *Iris virginica*, *Larix laricina*, *Liatriis spicata*, *Monarda fistulosa*, *Onoclea sensibilis*, *Panicum leibergii*, *Populus tremuloides*, *Pycnanthemum virginianum*, *Ratibida pinnata*, *Saxifraga pensylvanica*, *Silphium integrifolium*, *Smilacina racemosa*, *Solidago altissima*, *S. canadensis*, *S. gigantea*, *S. riddellii*, *S. rigida*, *Spartina pectinata*, *Thalictrum dasycarpum*, *Thelypteris palustris*, *Tradescantia ohiensis*, *Typha latifolia*, *Veronica missurica*, *Veronicastrum virginicum*, and *Zizia aurea* (Brewer 1965).

The resemblance of wet prairie to prairie fen is unmistakable. A few present day wet meadows may have once supported small areas of wet prairie. In some areas, wet prairie may have replaced tamarack swamp forest. Since few data are available describing Kalamazoo County wet prairies, I do not formally recognize variants in the annotated checklist; however, several variants are apparent, perhaps most notably, those in sandy situations and those in the floodplain of the

Kalamazoo River. Some interesting plants known only or primarily from sandy wet prairies include *Aletris farinosa*, *Agalinis gattereri* (extinct), *Platanthera ciliaris* (no longer extant in this habitat), *Scleria triglomerata* (possibly extinct), and *Viola lanceolata*.

A few small wet prairie remnants persist in Kalamazoo County; however, most are dominated by shrubs and exotic grasses due to fire suppression and frequent disturbance (especially grazing). One of the best remaining remnants is located between Stadium Dr. and the Amtrak RR right-of-way just SW of Howard St., W of the WMU campus within the right-of-way of the former Michigan Central RR, established in 1847 (MI Central RR). This site has a relatively rich prairie flora and would likely benefit from management. It is possible that with careful study other potentially recoverable remnants may be identified in Kalamazoo County. Brewer (1965) offers considerable insight into the floristic composition of a relatively undisturbed former wet prairie.

Shrub Dominated Wetland (Figure 4)

Inundated Shrub Swamp (SHRUB-SWAMP). Inundated shrub swamp is a shrub-dominated successional plant community intermediate between emergent marsh and swamp forest. Characteristically, the substrate is deeply inundated muck or occasionally, mineral soil. Inundated shrub swamp is frequently found in bog moats and locally in fen, but also occurs in other wet depressions such as in oxbow lakes, and ponds (esp. kettle holes), etc. There are several unique and predictable variants of inundated shrub swamp in Kalamazoo County, but none are sufficiently well-known or common enough to warrant separate treatment. In a broad sense, most inundated shrub swamps could probably be treated as components of other plant communities (bog, fen, floodplain forest, etc.). Taken as a whole some typical plants include *Alisma plantago-aquatica*, *Calla palustris*, *Cephalanthus occidentalis*, *Cornus amomum*, *C. stolonifera*, *Echinocystis lobata*, *Glyceria septentrionalis*, *Impatiens capensis*, *Juncus acuminatus*, *Leersia oryzoides*, *Lemna minor*, *Lycopus americanus*, *Penthorum sedoides*, *Polygonum arifolium*, *P. sagittatum*, *Ranunculus flabellaris*, *Rumex* sp., *Salix bebbiana*, *S. discolor*, *Scirpus atrovirens*, *Sparganium chlorocarpum*, *Typha latifolia*, and *Veronica scutellata* (Tyrrell 1987).

Shrub-Carr (SHRUB-CARR). Shrub carr usually forms a dynamic patchwork over the surface of fen, bog, wet meadow, and other wetland plant communities. Soil is usually saturated peat or muck, and the pH is variable. Shrub carr is a successional phase of vegetation favored by fire suppression, hydrologic manipulation, eutrophication, and other disturbances. Shrub carr is treated separately here since it has come to occupy a significant proportion of Kalamazoo County wetlands. In a broad sense, all shrub carr could probably be treated as a component of other plant communities (bog, fen, wet prairie, etc.). Taken as a whole, some typical plants include *Acer rubrum*, *Aster lanceolatus*, *Betula pumila*, *Calamagrostis canadensis*, *Cornus stolonifera*, *Eupatorium perfoliatum*, *Impatiens capensis*, *Onoclea sensibilis*, *Populus tremuloides*, *Salix discolor*, *S. bebbiana*, *Spiraea alba*, *Symplocarpus foetidus*, and *Toxicodendron vernix* (Sytsma & Pippen 1981b; 1982a; 1982b).

Forested Wetland (Figure 5)

A diversity of forested wetlands fall into this category, and it is possible to separate them into a multitude of variants. Taken as a whole they are often simply called, "swamp forests". To avoid splitting hairs I recognize just a few of the more common variants below and in the annotated checklist:

1. **Tamarack Swamp Forest.** Usually in mucky seepage areas, often associated with fen or bog.
2. **Pin Oak Swamp Forest** (not separated from Hardwood Swamp Forest in the annotated checklist). Usually on peaty, acid sand and locally dominated by Pin Oak, Black Oak, and Black-gum (this community is rare and little-known).
3. **Red Maple Swamp Forest.** Usually on acid substrates near lakeshores (often associated with bog) and with a well-developed shrub layer. Forests with White Pine and/or Tamarack mixed with Red Maple and other swamp forest species are sometimes segregated under the name of mixed hardwood-conifer swamp forest. However, relatively little such forest occurs in Kalamazoo County. Where it does occur, it typically dominates areas near lake edges, and intergrades with red maple swamp forest. Since it is relatively rare, and usually associated with red maple swamp forest, I have chosen not to treat it separately here.
4. **Black Ash Swamp Forest.** Usually at the edges of wooded uplands near streams and lakes where nutrient rich groundwater seepage saturates the muck substrate.
5. **Hardwood Swamp Forest.** Usually in depressions along streams and creeks such as in much of Wakeshma Tp.
6. **Floodplain Forest.** Known only from the floodplain of the Kalamazoo River and along part of August Creek.

Tamarack Swamp Forest (TAMARACK-SWAMP). Tamarack swamp forest is found mostly in glacial outwash and kettle depressions, but large stands also once occurred immediately N and E of the city of Kalamazoo along the Kalamazoo River. The substrate is usually saturated organic muck with variable pH (Sytsma & Pippen 1982a). The most notable characteristic is that the forest canopy is usually dominated by tamarack. Larch sawfly populations, flooding/drought, fire, and other natural processes are/were probably important factors affecting the floristic composition and structure of this community (in addition to variation in substrate conditions). Some typical species include *Acer rubrum*, *Betula pumila*, *Cypripedium calceolus*, *Larix laricina*, *Maianthemum canadense*, *Symplocarpus foetidus*, *Toxicodendron vernix*, *Trientalis borealis*, *Trillium flexipes*, and *Ulmus americana* (Sytsma & Pippen 1982a). Floristic composition seems to vary depending upon the amount and PH of groundwater seepage, but relatively little is actually known about the flora of remaining remnants, except that some sites mapped as this community type in Figure 5, now resemble red maple swamp forest, having apparently lost much of their former tamarack. The Haneses (1947) noted that tamarack was declining at a number of former sites. Some of the most intact, extensive, and species-rich remnants of

tamarack swamp forest are located near Flowerfield Creek (Prairie Ronde Tp.). Several bogs and fens support small, and unique stands of tamarack swamp forest. Little of this plant community remains in Kalamazoo County.

Red Maple Swamp Forest (RED-MAPLE-SWAMP). Red maple swamp forest is nearly restricted to saturated muck substrates at stream headwaters (such as near Flowerfield Creek in Prairie Ronde Tp.) and mucky peat substrates in outwash depressions (such as around the Sugarloaf Lakes & Goose Lake) primarily in Schoolcraft and Prairie Ronde Tps. White Pine, Black Ash, and Red Maple, are locally the dominant trees. Other typical plants include *Betula alleghaniensis*, *Coptis trifolia*, *Cypripedium calceolus*, *Dryopteris cristata*, *Ilex verticillata*, *Larix laricina*, *Lindera benzoin*, *Maianthemum canadense*, *Nemopanthus mucronata*, *Osmunda cinnamomea*, *O. regalis*, *Platanthera clavellata* (only in Prairie Ronde and Schoolcraft Tps.), *Poa paludigena*, *Rubus pubescens*, *Symplocarpus foetidus*, *Toxicodendron vernix*, *Trientalis borealis*, *Trillium flexipes*, *Ulmus americana*, *Vaccinium corymbosum*, and *Viburnum lentago*. Red maple swamp forest may be successional related to white-pine-dominated wetlands (probably resembling an open marshy pine forest) observed by the GLO surveyors in southern Schoolcraft Tp (Comer et al. 1997; Comer & Albert 1995). White-pine-dominated wetlands may have resulted from occasional or catastrophic fire in areas otherwise dominated by red maple swamp forest or tamarack swamp forest. Today, white pine is a locally important component of red maple swamp forest in Kalamazoo County.

Black Ash Swamp Forest (ASH-SWAMP). Black ash swamp forest is a relatively local but distinctive plant community usually replacing tamarack swamp forest or mixed hardwood swamp forest where nutrient rich groundwater seepage saturates the substrate. Some typical plants include *Acer rubrum*, *Asarum canadense*, *Fraxinus nigra*, *Lindera benzoin*, *Mitchella repens*, *Symplocarpus foetidus*, *Trientalis borealis*, *Trillium flexipes*, *Ulmus americana*, and *Zanthoxylum americanum*. Black ash swamp forest is not well known in Kalamazoo County.

Mixed Hardwood Swamp Forest (HARDWOOD-SWAMP). Mixed hardwood swamp forest usually occurs in wet depressions, often along streams. Soils are diverse in Kalamazoo County but regardless of their nature are almost always inundated in the spring. The forest canopy is usually dense. Trees are often shallow-rooted and prone to wind-throw, creating tree-fall gaps and a rather uneven forest floor. Typical plants include *Acer rubrum*, *A. saccharinum*, *Carex tribuloides*, *C. vulpinoidea*, *Fraxinus nigra*, *F. pensylvanica*, *Juglans cinerea*, *Laportea canadensis*, *Parthenocissus quinquefolia*, *Pilea pumila*, *Platanus occidentalis*, *Populus deltoides*, *Quercus bicolor*, *Symplocarpus foetidus*, *Toxicodendron radicans*, and *Ulmus americana*. Elm blight has much reduced the dominance of *Ulmus americana*. *Phalaris arundinacea* is a good indicator of disturbance. *Gymnocladus dioica* is an occasional element of mixed hardwood swamp forest in the SE¼ of the county, especially in northern Wakeshma Tp.

Floodplain Forest (FLOODPLAIN-FOREST). Floodplain forest is found on loam or silt loam with a neutral pH, only on the floodplains of Augusta Creek and the Kalamazoo River. Floodplain forests are host to many rare and habitat-restricted species and are relatively little-studied in Kalamazoo County. Some typical plants include *Acer negundo*, *A. saccharinum*, *Arisaema dracontium*, *Asarum canadense*, *Celtis occidentalis*, *Cercis canadensis*, *Euonymus atropurpurea* (now rare and local), *Fraxinus nigra*, *F. pennsylvanica*, *Gleditsia triacanthos*, *Juglans cinerea* (now rare), *Lindera benzoin*, *Lobelia cardinalis*, *Osmunda cinnamomea*, *O. regalis*, *Parthenocissus* spp., *Platanus occidentalis*, *Quercus bicolor*, *Q. muhlenbergii* (on moist levees), *Symplocarpus foetidus*, *Ulmus americana*, and *U. rubra* (more common prior to elm blight). *Populus deltoides* and *Salix nigra* are often found in former channels and along low riverbanks (Meagher & Tonsor 1992).

B. Terrestrial

Terrestrial Prairie (TERRESTRIAL-PRAIRIE) Figures 6, 14, 15.

Prairie plant communities once formed a conspicuous and significant feature of the Kalamazoo County landscape. They once covered approximately 21,584.1 acres (P. Comer pers. comm.). The former terrestrial prairies of Kalamazoo County were probably a dynamic patchwork of dry, dry-mesic, mesic, wet-mesic, and wet seasonal microclimates. Unfortunately, we do not know enough about the flora or hydrology of these former prairies to effectively classify most of them in this way. Further, the hydrology of these former prairies is probably not well-represented by the few very small and seriously altered extant remnants due to significant changes in local and regional water tables. Therefore, I have chosen to recognize all terrestrial prairies under the one name, *terrestrial prairie*. Numerous sources have been consulted in preparing this section. Some of the most frequently consulted publications, and others that may be of general interest to the reader include; Anderson 1990; 1983; Brewer 1985; 1984; Brewer et al. 1969; Chapman 1984; Chapman & Pleznac 1982; Cremin & DeFant 1987; Cremin & Quattrin 1987; Curtis 1959; Hanes 1947; Gleason 1913; Thompson 1975; Transeau 1935; Veatch 1928.

Terrestrial prairie occurred mostly on glacial outwash plains and in smaller patches on other landforms. Soils were usually sandy loam or loam. Prairies were probably maintained in large part by fires set by Native Americans (Cremin & DeFant. 1987; Cremin & Quattrin 1987). Sugar maple forest (see below) often developed where natural features served as firebreaks near former terrestrial prairies. The origin and age of these former prairies is unknown, however, the French explorer Rene Robert Cavalier, Sieur de La Salle passed through what may have been Gull Prairie in 1680 (Woodruff 1999). One of several hypotheses is that terrestrial prairies were formed through the destruction of forest by fire. Others suggest that the large former prairies such as Prairie Ronde, may have formed from post-glacial marshes. I am aware of no convincing data to support or refute either hypothesis or to suggest plausible alternative scenarios. It is interesting to note that the Haneses (1947) collected *Claytonia virginica* from several roadsides well within the former Prairie Ronde. Richard Brewer found *Hepatica americana* (though possibly a waif) growing along the MI Central RR



FIGURE 14. Unplowed fencerow and cemetery on Prairie Ronde (Prairie Ronde Tp.) photographed in mid-summer. Note the single flowering *Baptisia lactea* in the fencerow. *Silphium integrifolium* occurs nearby but cannot be seen in this photo. This is a former site for *Cirsium hillii*, and is host to one of just a few remaining extant populations of *Ranunculus fascicularis* and *Viola pedatifida* in Kalamazoo County.



FIGURE 15. Terrestrial prairie fencerow relict on Gourdneck Prairie (Schoolcraft Tp.) photographed in August with *Silphium integrifolium* and *Coreopsis tripteris*.

right-of-way through the northern border of Genesee Prairie (Brewer 1984, 1985). Although perhaps inconsequential, both species are typical spring wildflowers in many Kalamazoo County terrestrial forests.

Dominant terrestrial prairie plant species are mostly uncertain, but grasses including *Andropogon gerardii*, *A. scoparius*, *Panicum virgatum*, *Stipa spartea*, and *Sorghastrum nutans*, may have been the most abundant, and were probably local dominants. Mesic and dry-mesic prairies were probably the most widespread kinds of terrestrial prairie at the time of the GLO surveys. While they may have been droughty in summer and fall, I suspect that most were locally quite wet in the spring, with significant areas of standing water.

Anecdotal accounts by early settlers provide a glimpse of what these prairies were like.

"The prairie . . . seemed wondrously beautiful and grand. It was simply in a state of nature, covered with a pretty rank growth of grass, then [6 November 1831] dry and sere, no tree except the Big Island Grove ("Island Woods"), and one or two other small groves . . . Early in March the rank growth of last year's grass, dried by the sun and wind, was set on fire, and the whole prairie burned over, leaving it bare and black as midnight. Then in a few days came the beautiful flowers, covering the whole prairie with one uniform kind and color; first, the blue violet [Viola pedatifida], then the purple phlox [probably Phlox pilosa], and this succeeded by some other color. In July and August a tall, yellow flower, the name of which I do not know [probably Silphium integrifolium], mixed profusely with the tall grass [probably Andropogon gerardii], gave yellow as the predominating color. . . . But all was wild, with a peculiar, rank, sick smell, that even now almost brings back the shivers of the ague [recurring fever & chills caused by malaria]." (Brown, 1881, describing Prairie Ronde and Gourdneck Prairie).

"Ascending slightly from circumference to the center, yet so as to seem full rather than elevated; surrounded with a noble forest whose sharp-cut and perfect line was nowhere so distant as to be indistinct, yet so remote that the beams of the rising and setting sun seemed to blend in a mist of gold and purple . . . the whole plain was covered from spring to autumn with a gorgeous array of flowers, whose differing colors followed each other in due succession; at last faded and gone in the autumn winds" . . . (Van Buren 1888, describing Prairie Ronde, as quoted in Chapman 1984).

"I went out to Gull Prairie in the spring of [18] '33 with J. F. Gilkey; the prairie had been burnt over in the fall and the fresh green grass and the thousand wildflowers made it seem like a great garden. (Turner 1911, describing Gull Prairie).

" . . . beneath, about, and beyond me, as far as the eye could reach, was spread out, in undulating elegance, an emerald carpet of nature's choicest fabric, inlaid profusely with flowers of every imaginable variety of name and tint—gorgeous and fascinating as the most brilliant hues of the rainbow." (Taylor 1855 describing Grand Prairie, as quoted in Chapman 1984).

"To get an idea of Prairie Ronde, the reader must imagine an oval plain of some five-and-twenty or thirty thousand acres in extent, of the most surprising fertility, without an eminence of any sort; almost without an inequality. There are a few small cavities, however, in which there are springs forming large pools of

water that the cattle will drink. This plain, so far as we saw it, is now entirely fenced and cultivated. The fields are large—many containing eighty acres, and some one hundred and sixty; most of them being in wheat. We saw several fields of this size in that grain. Farm-houses dotted the surface, with barns, and the other accessories of rural life. In the center [sic] of the prairie is an “island” of forest [the Haneses “Island Woods” is today an unplowed 24 acre remnant of this forest], containing some five or six hundred acres of the noblest native trees we remember ever to have seen. In the center [sic] of this wood is a little lake, circular in shape, and exceeding a quarter of a mile in diameter [the Haneses (1947) “Island Pond”]. The walk in this wood, which is not an opening, but an old-fashioned virgin forest, we found delightful of a warm summer’s day” (Cooper 1848).

It is interesting to note that in the above passages, mention is made of burning Gull Prairie in the fall, and Prairie Ronde in the spring. It is not known exactly how often, and during what season of the year these prairies were traditionally set fire, but clearly fire was an exceeding important element of prairie ecology.

Early settler accounts, first botanical survey collections (Appendix I), and floristic inventories of disturbed terrestrial prairie remnants (including plants presumably persisting as relicts) suggest that some plants included were: *Ambrosia artemisiifolia*, *Amorpha canescens*, *Anemone cylindrica*, *Antennaria neglecta*, *Arenaria stricta*, *Artemisia caudata*, *Asclepias amplexicaulis*, *A. incarnata*, *A. tuberosa*, *A. verticillata*, *A. viridiflora*, *Aster ericoides*, *A. laevis*, *A. novae-angliae*, *A. oolentangiensis*, *A. pilosus*, *A. sericeus*, *Astragalus canadensis*, *A. neglectus*, *Baptisia lactea*, *B. leucophaea*, *Bouteloua curtipendula*, *Calamagrostis canadensis*, *Carex bicknellii*, *C. muhlenbergii*, *Cirsium discolor*, *C. hillii*, *Claytonia virginica*, *Comandra umbellata*, *Coreopsis palmata*, *C. tripteris*, *Corylus americana*, *Desmodium sessilifolium*, *Digitaria filiformis*, *Dioscorea villosa*, *Echinacea purpurea*, *Erigeron annuus*, *Eryngium yuccifolium*, *Euphorbia corollata*, *Geranium maculatum*, *Hedeoma hispida*, *Helianthus lateriflorus*, *H. occidentalis*, *H. strumosus*, *Krigia biflora*, *Kuhnia eupatorioides*, *Lespedeza capitata*, *Liatris punctata*, *Lithospermum canescens*, *Monarda fistulosa*, *Panicum leibergii*, *P. oligosanthes*, *P. perlongum*, *P. virgatum*, *Penstemon pallidus*, *Phlox bifida*, *P. pilosa*, *Platanthera lacera*, *Poa pratensis*, *Potentilla arguta*, *Pycnanthemum tenuifolium*, *Quercus macrocarpa*, *Ranunculus fascicularis*, *Ratibida pinnata*, *Rhus glabra*, *Rubus hispidus*, *Rosa setigera*, *Salix humilis*, *Scleria triglomerata*, *Silphium integrifolium*, *Sisyrinchium albidum*, *Solidago altissima*, *S. juncea*, *S. missouriensis*, *S. nemoralis*, *S. rigida*, *S. speciosa*, *Spartina pectinata*, *Specularia perfoliata*, *Sporobolus heterolepis*, *Taenidia integerrima*, *Thalictrum dasycarpum*, *Thaspium trifoliatum*, *Tradescantia ohiensis*, *Verbena stricta*, *Veronicastrum virginicum*, *Vicia americana*, *Viola pedatifida*, *V. sagittata*, *V. sororia*, and *Zizia aurea*.

The Haneses and subsequent collectors made many interesting botanical collections from along RR rights-of-way and roadsides through former prairies, especially through the former Prairie Ronde and Gourdneck Prairie. Some of these collections are of typically more southern and/or western prairie and savanna plants that are often thought to be adventive here. It is important to note however, that relatively few such species are known from non-prairie RR rights-of-

way and while certainly some of these purported waifs were probably never native in Kalamazoo County, some of them probably were. Some examples of such plants of uncertain status (native or adventive?) in the Kalamazoo County flora include: *Adlumia fungosa*, *Crotalaria sagittalis*, *Echinacea pallida*, *Glyceria acutiflora*, *Helianthus hirsutus*, *H. maximiliani*, *H. petiolaris*, *Parthenium hispidum*, *Phlox bifida*, *Silphium laciniatum*, *S. perfoliatum*, *Sporobolus asper*, and *Stipa comata*.

The following tables are a compilation of native prairie plants known from within the boundaries of 5 large former Kalamazoo County terrestrial prairies (See Figure 6 & Tables 5–9). Several of these species are reported based on collections made by the first botanical survey (Appendix I), others were collected much later, often along roadsides and/or RR rights-of-way. I have not included species that I strongly believe to be adventive. I have only indicated the source(s) for each report when not based on specimens in the WMU herbarium, specimens collected by the first botanical survey, or personal observations I made between 1994 and 2002. As such, these lists should be considered my subjective opinion. Other than palynological and phytolith studies, little else remains to further elucidate the relatively unknown former floras of these prairies. Many more plant species than are presented here have been collected from within the boundaries of the following prairies; however, most are exotics, weedy natives, or adventive. All of the following are, in my opinion, potentially native prairie species.

TABLE 5. Plants known from Genesee Prairie

<i>Achillea millefolium</i>	<i>Draba reptans</i> (Brewer 1984)	<i>Pteridium aquilinum</i>
<i>Ambrosia artemisiifolia</i>	<i>Elymus canadensis</i>	<i>Ranunculus fascicularis</i>
<i>Andropogon gerardii</i>	<i>Euphorbia corollata</i>	(Brewer 1984)
<i>Andropogon scoparius</i>	<i>Euthamia graminifolia</i>	<i>Ratibida pinnata</i>
<i>Angelica venenosa</i> (Brewer 1984)	<i>Fragaria virginiana</i>	<i>Rhus glabra</i>
<i>Anemone virginiana</i>	<i>Galium boreale</i>	<i>Rhus typhina</i>
<i>Antennaria parlinii</i>	<i>Geranium maculatum</i>	<i>Rosa carolina</i>
<i>Apocynum cannabinum</i>	<i>Hepatica americana</i> (Brewer 1984)	<i>Rudbeckia hirta</i>
<i>Arenaria stricta</i>	<i>Heuchera richardsonii</i> (Brewer 1984)	<i>Salix humilis</i>
<i>Asclepias tuberosa</i>	<i>Lathyrus venosus</i>	<i>Silphium integrifolium</i>
<i>Aster laevis</i> (Brewer 1984)	<i>Liatris aspera</i> (Brewer 1984)	<i>Smilacina racemosa</i>
<i>Aster pilosus</i> (Brewer 1984)	<i>Liatris scariosa</i>	<i>Solidago canadensis</i>
<i>Aster sagittifolius</i>	<i>Lysimachia quadrifolia</i>	<i>Solidago gigantea</i>
<i>Carex bicknellii</i>	<i>Monarda fistulosa</i>	<i>Solidago juncea</i>
<i>Carex pensylvanica</i>	<i>Panicum leibergii</i> (Brewer 1984)	<i>Solidago nemoralis</i>
<i>Ceanothus americanus</i> (Brewer 1984)	<i>Phlox pilosa</i>	<i>Solidago rigida</i>
<i>Cirsium hillii</i> (pers. obs.)	<i>Physalis</i> sp.	<i>Sorghastrum nutans</i>
<i>Comandra umbellata</i>	<i>Polygonatum biflorum</i>	<i>Sporobolus cryptandrus</i>
<i>Coreopsis tripteris</i>	<i>Potentilla arguta</i> (Brewer 1984)	<i>Symphoricarpos orbiculatus</i>
<i>Cornus racemosa</i>	<i>Potentilla simplex</i>	(Brewer 1984)
<i>Corylus americana</i>	<i>Prenanthes alba</i>	<i>Taenidia integerrima</i>
<i>Desmodium canadense</i>		<i>Thalictrum dioicum</i>
<i>Dioscorea villosa</i>		<i>Tradescantia ohiensis</i>
		<i>Veronicastrum virginicum</i>
		<i>Vicia americana</i>

TABLE 6. Plants known from Gourdneck Prairie

<i>Andropogon gerardii</i>	<i>Baptisia lactea</i>	<i>Kuhnia eupatorioides</i>
<i>Asclepias viridiflora</i>	<i>Carex bicknellii</i>	<i>Panicum virgatum</i>
<i>Asclepias tuberosa</i>	<i>Coreopsis palmata</i>	<i>Phlox pilosa</i>
<i>Aster ericoides</i>	<i>Coreopsis tripteris</i>	<i>Ratibida pinnata</i>
<i>Aster novae-angliae</i>	<i>Elymus canadensis</i>	<i>Silphium integrifolium</i>
<i>Aster ontarionis</i>	<i>Eryngium yuccifolium</i>	<i>Solidago missouriensis</i>
<i>Aster pilosus</i>	<i>Euphorbia corollata</i>	<i>Specularia perfoliata</i>
<i>Aster sericeus</i>	<i>Helianthus strumosus</i>	<i>Viola pedatifida</i>
<i>Aster umbellatus</i>	<i>Krigia biflora</i>	

TABLE 7. Plants known from Grand Prairie

<i>Andropogon gerardii</i>	<i>Asclepias viridiflora</i>	<i>Bouteloua curtipendula</i>
<i>Arenaria stricta</i>	<i>Baptisia lactea</i>	<i>Linum sulcatum</i>
<i>Asclepias tuberosa</i>	<i>Baptisia leucophaea</i>	<i>Scleria triglomerata</i>

TABLE 8. Plants known from Gull Prairie

<i>Andropogon gerardii</i>	<i>Echinacea purpurea</i>	<i>Potamogeton pectinatus</i>
<i>Asclepias tuberosa</i>	<i>Elymus canadensis</i>	<i>Silphium integrifolium</i>
<i>Coreopsis palmata</i>	<i>Krigia biflora</i>	<i>Veronicastrum virginicum</i>
<i>Coreopsis tripteris</i>	<i>Kuhnia eupatorioides</i>	<i>Viola pedatifida</i>

TABLE 9. Plants known from Prairie Ronde

<i>Amorpha canescens</i>	<i>Desmodium illinoense</i>	<i>Pycnanthemum tenuifolium</i>
<i>Andropogon gerardii</i>	<i>Elymus canadensis</i>	<i>Ranunculus fascicularis</i>
<i>A. scoparius</i>	<i>Erigeron annuus</i>	<i>Ratibida pinnata</i>
<i>Artemisia caudata</i>	<i>Eryngium yuccifolium</i>	<i>Rosa setigera</i> (in the "Island" woods)
<i>Asclepias amplexicaulis</i>	<i>Euphorbia corollata</i>	<i>Salix humilis</i>
<i>Asclepias tuberosa</i>	<i>Helianthus occidentalis</i>	<i>Scrophularia lanceolata</i>
<i>Asclepias verticillata</i>	<i>Helianthus strumosus</i>	<i>Silphium integrifolium</i>
<i>Asclepias viridiflora</i>	<i>Krigia biflora</i>	<i>Silphium perfoliatum</i> (poss. adventive)
<i>Aster ericoides</i>	<i>Kuhnia eupatorioides</i>	<i>Sisyrinchium albidum</i>
<i>Aster novae-angliae</i>	<i>Lechea minor</i>	<i>Solidago juncea</i>
<i>Aster ontarionis</i>	<i>Lespedeza capitata</i>	<i>Solidago nemoralis</i>
<i>Aster pilosus</i>	<i>Liatris punctata</i>	<i>Sorghastrum nutans</i>
<i>Aster sericeus</i>	<i>Lithospermum canescens</i>	<i>Spartina pectinata</i>
<i>Astragalus canadensis</i>	<i>Panicum virgatum</i>	<i>Specularia perfoliata</i>
<i>Astragalus neglectus</i>	<i>Panicum philadelphicum</i>	<i>Stipa spartea</i>
<i>Baptisia lactea</i>	<i>Penstemon pallidus</i>	<i>Teucrium canadense</i>
<i>Baptisia leucophaea</i>	<i>Phlox bifida</i> (poss. adventive)	<i>Thaspium trifoliatum</i>
<i>Carex bicknellii</i>	<i>Phlox pilosa</i>	<i>Veronicastrum virginicum</i>
<i>Cirsium hillii</i>	<i>Platanthera lacera</i>	<i>Viola pedatifida</i>
<i>Claytonia virginica</i>	<i>Polygala senega</i>	<i>Zizia aurea</i>
<i>Coreopsis palmata</i>	<i>Potentilla arguta</i>	
<i>Corylus americana</i>	<i>Potentilla anserina</i>	

Terrestrial Shrub/Savanna (Figure 6)

Savannas have an open canopy and are usually maintained by fire (Comer et al. 1997; Comer et al. 1995). Oaks, especially *Q. alba*, *Q. velutina*, *Q. macrocarpa*, and *Q. prinoides* were/are important. The division of oak savannas into variants is difficult since only a very few small remnants remain. Thus, like prairies, much of what we presume to know about savannas comes from small, highly altered sites, accounts by early settlers, and notes from the GLO surveys (Anderson 1983; Archambault et al. 1990; 1989; Beal 1902; Chapman 1984; Chapman & Pleznac 1982; Legge et al. 1995; Minc & Albert 1990; Peters 1970; Whitford 1976; Wing 1937). Relatively little is known about the pre-European settlement floras and natural history of different kinds of savanna. There is now (and probably always has been) considerable local variation in the floristic composition of Kalamazoo County savannas.

I often use the catch-all term oak savanna in this flora when more detail is not available and/or practical. Uncultivated or otherwise relatively intact former oak savanna has all succeeded to oak hardwood forest except where disturbance has helped maintain an open forest canopy. Savanna-like plant assemblages often occur at degraded former sites such as along old RR rights-of-way, in pastures, and in old fields that are undergoing regeneration to oak hardwood forest. Thus, when the terms oak savanna or oak hardwood forest are used in this flora, the reader should be aware that the distinction is not today altogether clear, especially since many sites have complex and varied disturbance histories. Further, some of the small remnants that serve as the basis for reporting of plants from oak savanna in the annotated checklist are called oak savanna only because they once were oak savanna, and today retain (at least locally) portions of their presumed former floras. They may otherwise have relatively closed canopies or may lack canopy cover entirely due to past cultivation or timber harvesting. Much research remains to be done to further elucidate the degree to which sites with various cover types and disturbance histories will recover under different management regimes.

Black Oak Barren (BLACK-OAK-BARREN) Figures 16–17. Black oak barren is a variant of savanna usually found on undulating, well-drained sand or sandy loam. Black oak barren once covered approximately 40,240.5 acres (P. Comer pers. comm. 1997). It was maintained primarily by fire and perhaps to a much lesser extent by drought, but most Kalamazoo County oak barrens were probably not burned every year. Prior to settlement, most BLACK-OAK-BARREN probably was composed of a mosaic of scattered and clumped small trees (mostly *Quercus velutina*) and shrubs (*Ceanothus americanus*, *Prunus americana*, *P. nigra*, *Quercus prinoides*, young *Quercus velutina*, *Rhus copallina*, *Rubus flagellaris*, and others) in a matrix of grasses, sedges, and herbaceous plants. Due to variable topography and substrate conditions, these oak savannas are/were relatively species rich, especially the formerly extensive BLACK-OAK-BARRENS in the western half of the county. The grasses in rich secondary remnants in Oshtemo Tp. are mostly *Andropogon scoparius* and *Sorghastrum nutans*. The sedge *Carex pensylvanica* dominates below shrubs and in shady areas, especially at disturbed sites. In addition to fire, drought probably also



FIGURE 16. Reconstructed black oak barren S of the commuter lot at the intersection of Centre Street and US 131 (Portage Tp.) photographed in August.



FIGURE 17. Close-up of ground cover near a clump of small black oaks at the above site (photographed in August). Notice the abundance of *Amorpha canescens* and *Liatris aspera*.

helped maintain the open character of this plant community. Most extant remnants occur on very well-drained sites where drought and/or past cultivation, not fire, have delayed the development of oak hardwood forest. Some typical plants (in addition to the aforementioned grasses and *Carex pensylvanica*) today include *Amorpha canescens*, *Amphicarpaea bracteata*, *Apocynum androsaemifolium*, *Arabis lyrata*, *Artemisia campestris*, *Asclepias amplexicaulis*, *Aster sagittifolius*, *Aureolaria* spp., *Carex muhlenbergii*, *Ceanothus americana*, *Corylus americana*, *Euphorbia corollata*, *Galium boreale*, *Helianthemum canadense*, *Helianthus divaricatus*, *H. occidentalis*, *Lathyrus ochroleucus*, *Lespedeza capitata*, *L. hirta*, *Liatris aspera*, *Lupinus perennis*, *Monarda fistulosa*, *Panicum praecocius*, *Pteridium aquilinum*, *Quercus alba*, *Rhus typhina*, *Sassafras albidum*, *Solidago nemoralis*, *Tephrosia virginiana*, *Tradescantia ohioensis*, and *Viola pedata*. Ground cover by *Poa compressa* usually indicates past disturbance (Faber-Langendoen & Tester 1993; Heikens & Robertson 1994; Homoya 1994; Hutchison 1994; Kenoyer 1929; Pokora 1968).

A nice BLACK-OAK-BARREN reconstruction occurs immediately south of the commuter lot at the intersection of Centre St. and US 131 (between Angling Rd. and US 131), and a degraded but species-rich remnant occurs at the public access site on Eagle Lake. According to the Haneses, black oak barren developed at Austin and Eagle Lakes on small lakeside sand dunes (none of which appear to have been true open dunes, but rather, oak hardwood forest and black oak barren with disturbed areas of open sand). At Austin Lake these "dunes" were home to the county's only population of *Arctostaphylos uva-ursi* (since extirpated) (Hanes & Hanes 1947). The largest remaining quality remnant (mostly secondary, but very large and species rich and with some areas that probably have not been cultivated) is located along and north of the right-of-way of the former MI Central RR in extreme western Oshtemo Tp. Much of the site is currently undergoing residential development. *Amorpha canescens* is limited to portions of the former RR right-of-way that appear to have escaped cultivation. To my knowledge no other significant remnants of BLACK-OAK-BARREN remain in Kalamazoo County.

Bur Oak Savanna (BUR-OAK-SAVANNA) Figures 18–19. Bur oak savanna is a formerly widespread oak savanna type reduced perhaps to a single very small remnant with a partly intact groundcover layer near the WMU campus. It once covered approximately 7,730.8 acres (P. Comer pers. comm. 1997). This community is sometimes called "bur oak plain," "bur oak opening," "oak opening," or just "opening" (but the terms "oak opening" and "opening" usually apply to white oak savanna and can include associated prairie). Bur oak savanna once occurred almost exclusively on level to gently undulating terrain. It was often situated between prairie and white oak savanna. Bur oak is exceptionally fire-resistant, and fire appears to have played an important role in the structure and dynamics of this little-known plant community (Brewer & Kitler 1989; Veatch 1953; Wing 1937).

Early settler accounts and inventories of a few heavily disturbed remnants (only one of which is now extant) suggest that bur oak savannas were usually covered with a scattered growth of shrub to apple orchard sized trees, predomi-



FIGURE 18. Disturbed remnant bur oak savanna along the right-of-way of the former MI Central RR just W of the WMU campus (Kalamazoo Tp.). This picture, taken in mid-August, shows a striking display of flowering *Silphium integrifolium* intermixed with *Quercus macrocarpa* grubs, *Andropogon gerardii*, and several other prairie and savanna plants. This site has been disturbed by road and railway construction in the past, but to my knowledge it has never been cultivated. As of May, 2004, this site remained intact but unprotected. It is the last remaining remnant of bur oak savanna with a partially intact groundcover in Kalamazoo County. Despite being home to hundreds of plants of the state threatened *Silphium integrifolium*, and at least a few dozen plants of the state threatened *Panicum leibergii*, it will soon be destroyed by commercial development (anonymous pers. comm.).

nantly *Quercus macrocarpa* (Bur Oak), but a few *Q. velutina*, *Q. alba*, and *Carya ovata* (Brewer & Kitler 1989). Bur Oak has the ability to form “grubs”; woody underground stems with the ability to resprout following fire damage to the aboveground portion of the plant (Whitford 1976). Tree size and stem density probably varied within and between sites over time due to variation in the frequency and intensity of fires, landscape position, and other factors.

Bur oak savannas often adjoined or bordered prairies, or occurred alone in large stands sometimes called bur oak plains. Anecdotal evidence suggests that Bur Oak may have actively colonized terrestrial prairies from their edges. In fact, many of the large former terrestrial prairies show evidence of having decreased in size in the years leading up to the GLO surveys of 1826–1830. Thus, there is a chance that some of the bur oak savanna (and perhaps other kinds of savanna) in the immediate vicinity of prairies in Kalamazoo County one time or another may have been treeless terrestrial prairie.



FIGURE 19. Former bur oak savanna on the N edge of Prairie Ronde (Prairie Ronde Tp.). This even-aged stand of mostly *Quercus macrocarpa* has grown up from former grubs or small trees that once formed a savanna on the N edge of Prairie Ronde. The understory retains no typical prairie or savanna plants due to many years of mowing and lawn treatment. Many such vestiges of former oak savanna persist in Kalamazoo County. Photographed in late winter/early spring.

The ground layer in bur oak savanna was probably similar to adjacent wet-mesic to dry-mesic terrestrial prairie. What little is known about bur oak savanna is biased towards wetter sites since all relatively dry sites have been cultivated or long ago succeeded to forest. A few plants typically persisting as relicts include *Andropogon gerardii*, *Eryngium yuccifolium* (no longer extant in this community), *Galium boreale*, *Panicum leibergii*, *P. virgatum*, *Quercus macrocarpa*, *Q. velutina*, *Q. alba*, *Ratibida pinnata*, *Spartina pectinata*, and *Silphium integrifolium*. *Corylus americana* was probably an important shrub, especially near watercourses (pers. obs.). Very little is known about the pre-European settlement state or structural diversity of this globally endangered and once relatively common plant community. A few former sites in Kalamazoo County retain at least some of their original trees, but the savanna groundcover has been mostly or entirely eliminated (Brewer & Kitner 1989; Minc & Albert 1990). The best and perhaps the only relatively intact remaining small remnant in Kalamazoo County occurs along the right-of-way of the former MI Central RR just west of the WMU campus near the advertising billboards along Stadium Dr. A few sites that have grown up into forest may warrant management.

James Fennimore Cooper's book "Oak Openings" describes the former oak

savannas including bur oak savanna. "Oak Openings" is set on Prairie Ronde, and was completed in 1848 from notes taken by Cooper at Schoolcraft, MI (on Prairie Ronde), Cooper writes:

... "like so many orchards on the summit of a gentle swell of land, on the border of a marsh, prairie, or lake The country was what is termed "rolling" . . . although wooded, it was not as the American forest is wont to grow, with tall straight trees towering toward the light, but with intervals between the low oaks that were scattered profusely over the view The trees, with few exceptions, were what is called the "burr-oak," a small variety of a very extensive genus; and the spaces between them, always irregular, and often of singular beauty, have obtained the name of "openings"; the two terms combined giving their appellation to this particular species of native forest, under the name of "oak openings" . . . the trees were of very uniform size, being little taller than pear trees . . . and having trunks that rarely attain two feet in diameter . . . in places they stand with regularity resembling an orchard, then, again, they are more scattered and less formal, while breadths of the land are occasionally seen in which they stand as copses, with vacant spaces, that bear no small affinity to artificial lawns, being covered with verdure. The grasses are supposed to be owing to the fires periodically lighted by the Indians in order to clear their hunting grounds" (Cooper 1848).

Other accounts by early settlers of the region shed further light on the structure of this community.

"There is quite an idea that this village site (Kalamazoo) was a grassy plain with [a] scattering [of] bur oaks; but it was a plain covered with thick and tall hazel brush (*Corylus americana*), so thick that I have seen a wolf jump up so as to see what caused the row he heard; and the burr oaks [sic] were very small, little more than grubs. There stands now on West Street [Westnedge Ave.] an oak perhaps two feet through, with a doctor's sign upon it, that when I lived on the spot, several years after I came here, was about the size of a whip stock after I had trimmed it into shape. There was perhaps an acre of clear ground about the mound in the park [Bronson Park]" (Turner 1911).

... On the one hand stretched bur-oak plains, spread with a verdant carpet, variegated with dazzling wildflowers, without an obstacle to intercept the view for miles, save the somber trunks of the low oaks, sparsely spreading their shadows across the lawn; on the other hand arose the undulations of the white oak openings, with picturesque outlines of swells and slopes gracefully sweeping and sharply defined in the distance. (Coffinberry 1880, describing the area in the vicinity of Nottawa-Sippi Prairie, northeast St. Joseph County, in 1825, as quoted in Chapman 1984).

White Oak Savanna (WHITE-OAK-SAVANNA) Figures 20–22. White oak savanna is a formerly widespread plant community that along with its characteristic flora is nearly extinct. White oak savannas once covered approximately 79,746.8 acres (P. Comer pers. comm.), were found mostly on dry to mesic sandy-loam and loamy-sand, and were usually located in areas of level to rolling topography, often "unhill" from bur oak savanna. This community is often called "white oak opening," "oak opening" (but the term "oak opening" also was applied to bur oak savanna and associated prairie), or just "opening." Trees were predominantly *Quercus alba* (White Oak), but *Q. macrocarpa*, *Q. velutina*, *Carya ovata*, and other trees were probably present in smaller numbers (pers. obs.). Tree size probably varied from site to site due to variation in the frequency and intensity of fires, drought, and other disturbances. The ground layer in this community may have shared many characteristics with terrestrial prairie, but



FIGURE 20. White oak savanna remnant along the former right-of-way of the MI Central RR. This is perhaps the finest example of white oak savanna remaining in Kalamazoo County, and is the last place in the county where *Angelica venenosa* (middle foreground) is known to occur. *Coreopsis tripteris* can also be seen in the foreground. The opening in the background is dominated by the grasses *Andropogon gerardii* and *Sorghastrum nutans*, and includes a significant and relatively unique herbaceous flora. Photographed in August. This site and an adjacent site with a similarly rich and endangered flora (including the only known extant individual of *Cirsium hillii*) were still intact as of May, 2004, but will soon be destroyed by commercial development (anonymous pers. comm.).

probably included many plants today occasional in open oak hardwood forest. White oak savannas were structurally diverse in Kalamazoo County, and the few highly altered remnants that remain reveal little about the pre-European settlement character of this plant community (Minc & Albert 1990; Veatch 1928; Whitford 1976; Wing 1937).

Taken as a whole, some typical plants of remnant white oak savanna today include; *Amorpha canescens*, *Andropogon gerardii*, *A. scoparius*, *Anemone cylindrica*, *Asclepias purpurascens*, *Arnoglossum atriplicifolium*, *Carya ovata*, *Cornus foemina*, *Corylus americana*, *Frasera caroliniensis*, *Helianthus occidentalis*, *Phlox pilosa*, *Pteridium aquilinum*, *Quercus alba*, *Q. macrocarpa*, *Q. velutina*, *Solidago nemoralis*, *Sorghastrum nutans*, and *Frasera carolinensis*. *Angelica venenosa*, *Asclepias purpurascens*, *Liatris scariosa*, and *Silene stellata* are known



FIGURE 21. Early fall close-up view of the ground cover of the above white oak savanna along the former right-of-way of the MI Central RR. *Andropogon gerardii*, *Liatris scariosa*, *Solidago nemoralis*, and *Sorghastrum nutans* can be seen in the foreground.



FIGURE 22. Overgrown former white oak savanna (Cooper Tp.) with *Frasera caroliniensis* persisting along the roadside. Sixty years ago this site supported many other typical savanna plants (Hanes & Hanes 1947), but heavy shade has since developed here, and most of the former savanna plants have disappeared. Notice the many young *Acer saccharum* in the subcanopy and understory. Photographed in August.

only from former white oak savanna and perhaps adjacent prairie edges (Brewer 1984) in Kalamazoo County.

Many former sites of white oak savanna retain at least some of their original trees, but the savanna groundcover has been entirely eliminated. Sometimes a few relatively shade tolerant species such as *Arnoglossum atriplicifolium* and *Frasera caroliniensis* persist at oak hardwood forest edges (extant oak hardwood forests are often derived from overgrown oak savanna). A few oak hardwood forests persisting near the former prairies (especially Prairie Ronde) retain a portion of their presumed original savanna floras and may be at least partly recoverable with significant management. To my knowledge only one significant (but probably secondary) relatively intact remnant remains. It is located on the NE corner of the intersection of US 131 and Stadium Dr. in an old field corner adjacent to the former right-of-way of the MI Central RR.

Terrestrial Forest

Sugar Maple Forest (SUGAR-MAPLE-FOREST). Sugar maple forest is a widespread plant community in mostly mesic situations on silty or clayey soil. It once covered approximately 76,236.3 acres (P. Comer pers. comm. 1997). Usu-

ally a dense canopy is formed that is dominated by hardwoods such as Sugar Maple and American Beech. Young Sugar Maple may locally dominate the understory. Typically this is a very stable, terminal forest condition in the absence of fire. It is usually absent from level to rolling areas of former oak savanna and prairie except where wetlands or topography apparently served as fire breaks. On poorly drained sites, *Fagus grandifolia* is usually absent, and *Celtis occidentalis* can be relatively abundant.

The island woods, immediately W of the town of Schoolcraft, is a remnant of moderately drained sugar maple forest once isolated from surrounding forests by the former Prairie Ronde (see "Terrestrial Prairie"). It contains the only known population of *Aesculus glabra* and only known extant population of *Erythronium albidum* in Kalamazoo County (Brewer 1966b, 1980; Fleckenstein & Pippen 1977; Hanes 1944; Zager & Pippen 1977).

A variant of sugar maple forest with *Quercus muhlenbergii* scattered in the canopy, and a rather unusual understory flora occurs on moist levees (called islands by the Haneses) in a matrix of floodplain forest near the Kalamazoo River, mostly E of the city of Kalamazoo. *Hybanthus concolor* is known in Kalamazoo County only from this local variant of sugar maple forest.

Oak Hardwood Forest (OAK-HARDWOOD-FOREST). Oak hardwood forest is the most widespread and abundant forest type in Kalamazoo County today. It once covered approximately 78,209.1 acres (P. Comer pers. comm. 1997). The canopy in oak hardwood forest is usually less dense than in sugar maple forest. Oak hardwood forest shares many features with oak savanna, with which it is successional related, and from which it is differentiated by having a greater density of trees (Comer et al. 1997; Comer et al. 1995). One to several species of oak and hickory, or oak and other hardwoods including young Sugar Maple usually dominate, depending on the history of the site, location, and substrate conditions.

Without fire, oak hardwood forest is generally not a stable climax and will slowly succeed to sugar maple forest (Brewer 1973; Cottam 1949; Curtis 1959; Robertson & Heikens 1994). Today's oak hardwood forests differ from their pre-European settlement namesakes in containing many fire-intolerant trees, shrubs, and saplings (such as Sugar Maple, Red Maple, and American Beech), and in exhibiting a closed or nearly closed forest canopy. Oak hardwood forest was once subjected to occasional fires, preventing, or at least reducing the establishment of the aforementioned fire-intolerant trees, and facilitating regeneration and establishment of oaks, hickories, and other characteristic native trees and shrubs. The former prairie component of the understory of these forests has been largely lost, but vestiges of the hardiest species (especially at sites of overgrown former oak savanna) are still sometimes found at forest edges.

Oak hardwood forest is sometimes composed of even-aged stands of mostly *Quercus alba*, *Q. macrocarpa*, or *Q. velutina* resulting from fire suppression in former oak savanna, or more frequently, cutting followed by regeneration, or some other similar scenario. Large, perhaps original, oaks or hickories, sometimes called "wolf trees" occasionally persist in otherwise younger stands, espe-



FIGURE 23. Overgrown hillside prairie near McGinnis Lake (Climax Tp.) photographed in winter. This is a former site for *Besseyia bullii*, and *Bouteloua curtipendula*. Notice how the openings between large trees have been overgrown with shrubs and small trees.

cially along roadsides, lakeshores, and at wetland edges (Curtis 1959). A very few remnants, mostly on steep hillsides, are dominated by even-aged stands of very large old trees, and may represent cut-over or perhaps even uncut and now overgrown former savanna. Some stands are composed almost entirely of oak, and approach what is sometimes called mixed oak forest.

Original, uncut oak hardwood forest is very rare (if it exists at all) in Kalamazoo County despite its former abundance. Disturbed remnants and young stands are frequent throughout the county. Important trees include *Quercus alba*, *Q. macrocarpa*, *Q. rubra*, *Q. velutina*, and *Carya ovata*.

Very dry, oak-dominated forests, such as in the Al Sabo Land Preserve in Texas Tp., are called dry forests by some authors.

Dry, relatively open hillsides, sometimes called hillside prairies, are floristically similar to oak hardwood forest but usually also have significant prairie and savanna components (Figure 23).

A small patch of mixed oak forest occurred on the W edge of Prairie Ronde Tp. at the time of the GLO surveys of 1826–1830. Relatively little is known about this former plant community since former remnants have been cut and/or have succeeded to oak hardwood forest. Some former black oak barren that has succeeded to forest, and some relatively isolated stands of oak resulting from succession in former white oak savanna, such as in the cities of Kalamazoo and

Portage, may superficially resemble mixed oak forests, but often lack a significant native understory.

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On the cover: *Purple Milkweed*, *Asclepias purpurascens*, photographed in section 28 of Texas Township, Kalamazoo County, Michigan, in 1996. This documents the last time this once relatively common savanna species is known to have flowered in Kalamazoo County. In 1999, following two years during which yard waste was dumped on and near the plants, only one non-flowering stem remained. There is a slight chance that other small populations or isolated individuals persist, but clearly this species is nearly extinct in Kalamazoo County.

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A CHECKLIST OF THE VASCULAR FLORA OF WOODLAND DUNES NATURE CENTER, MANITOWOC— TWO RIVERS, WISCONSIN.

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ABSTRACT

A floristic survey of the vascular plants of Woodland Dunes Nature Center was conducted over a period of approximately twenty years. I found 336 species, belonging to 300 genera and 70 families, in the area, which encompasses 1200 acres.

INTRODUCTION

A local flora is important to recognize and document for several reasons. It can serve as a baseline for comparisons to other local, regional and state floras today as well as into the future. It also provides information about various species presence and absence. In fact, in the course of this study, many new county records were established. Finally, these records will currently add to a major project underway to list the flora of Wisconsin (Checklist of the Vascular Plants of Wisconsin, 2001).

This study was concentrated in an area that has changed in many respects over the years. The initial holdings associated with the area were quite minimal and over time have grown considerably; i.e., 40 acres in 1974 to 1200 acres in 2004 (Woodland Dunes Web site: History). Land areas that were initially purchased and that had been used for agrarian or residential purposes are undergoing succession. This study then is in no way complete, as floras are always in a constant state of flux.

LOCATION AND LAND USE

Woodland Dunes Nature Center is located in Manitowoc County between the cities of Manitowoc and Two Rivers (Fig. 1). The current acreage associated with the Center amounts to approximately 1200 acres.

The map, Fig. 1, shows the boundaries and areas associated with the Center. The Center and its natural areas are in the West Two Rivers Township of Manitowoc County, T19-20N and R24E and R25E. The sections in the township where collections were made are numbers 35, 3, 2, and 10.

Agriculture was the main contemporary land use in the area and subsequently residential as well as commercial development has taken place.

The Center came into being in 1965 as an outgrowth of various avian and educational studies by local educators/naturalists. In 1974, a committee was established with the goal to preserve approximately 1,200 acres for habitat and educational purposes. Today the Center provides educational programs, a trail system, and outdoor opportunities for the public.

GEOLOGICAL AND PHYSIOGRAPHICAL FEATURES

Cambrian formations of Paleozoic age underlie the study area sampled (Ostrom, 1981). Above the Cambrian formations are five approximately parallel units of sedimentary rocks of Ordovician, Silurian, and Devonian age. From east to west the eroded edges of these rocks appear in the following order: St. Peter sandstone; Sinipee dolomite, with some limestone and shale; Maquoketa shale and dolomite; dolomite; and dolomite as well as shale.

Like most of Wisconsin, the Woodland Dunes area was affected by glaciations. Various glacial lake forces had a more significant impact on the area than did the inland glacial stages. The glacial lakes that influenced the area started with the glacial Lake Algonquin, followed by Lake Chippewa, and finally Lake Nipissing. The last had the most significant impact on the Woodland Dunes Area. During this last glacial lake episode, the lake level was approximately 596 feet above mean sea level which is referred to as the Algoma level (Steffen, 1979). The present area associated with the dunes was once more completely inundated. Later in time, the lake level dropped to its present level of 580 feet above mean sea level. Within this time frame, the lake forces along with the lake level recession formed the beach ridges and swales.

These formations at Woodland Dunes differ from other nearby areas along the lake. In most nearby areas, remnant ridges and swales, reflecting the higher lake levels, run parallel to the current shoreline. By contrast, the Woodland Dunes ridges and swales are fan shaped. The base or pivot point of the fan shaped ridges begins in the southeast corner of West Two Rivers township section 10, and then fans out to the northeast into sections 3, 2, and 35 (see Fig. 1). These fan shaped ridges and swales are thought to have developed as a result of an embayment that covered the present day Woodland Dunes area (Steffen, 1979). As the water level receded, the southeastern end of the embayment served as a major deposition point for the ridge/dune forming beach sand; while at the same time, beach sand deposits to the northeast were laid down in much smaller amounts. Consequently, the ridges and swales were formed in an unequal manner, wider or farther apart at the north end, and shorter or closer together at the south end (see Fig. 2).

SOILS

Woodland Dunes Nature Center is in an area dominated by soils that are underlain by outwash deposits. The soils are referred to as the Granby-Oakville-



FIGURE 2. Fan-shaped ridges and swals associated with Woodland Dunes.

Tedrow unit. This unit is further described as consisting of soils on outwash plains that are physically interrupted by drainage outlets, old remnants of beaches and glacial lake beds (Soil Survey of Calumet and Manitowoc Counties, 1975). The Granby is the dominant soil type in the area. It is described as follows: topsoil: ca. 10 inches of fine, black sandy loam; and subsoil: ca. 26 inches of an upper brown, loamy fine sand followed directly below by a light yellowish brown sand. In the western part of section 10 of W Two Rivers Township there are Keowns soils as well as Shiocton soil types which are both essentially sandy loams. Interspersed with the Granby throughout all sections, and as well to the east in section 35, are the Tedrow loamy fine sands. To the north in section 35 one encounters Houghton muck along the West Twin River boundary of the Center (Fig. 1).

CLIMATE

The climate associated with the Woodland Dunes Nature Center is described as a modified continental climate (Otter, 1975). The reason for the designation as a modified continental climate is its proximity to Lake Michigan. The lake's influence is felt most strongly in the spring, summer, and fall. The mean average temperature for the area (thirty year data for Manitowoc, WI from weather.com, November 2003) is approximately 43.3° F or 6.3° C. The monthly mean average temperatures run from 19° F or -7° C in January to 70° F or 21° C in July. The average date for the last spring freeze is 17 May and the first fall freeze is around 2 October. The growing season averages around 138 days. Mean annual precipitation, including snowfall, is 30.48 inches. The prevailing wind is from the west, northwest, and southwest with average speeds of 13 miles per hour in April and November.

VEGETATIONAL COMMUNITIES AND HABITAT TYPES

The location of Woodland Dunes Nature Center with respect to Lake Michigan and the "tension zone" results in an interesting mix of plant communities as well as habitats. As indicated above and in general terms, the climate associated with Woodland Dunes is cooler, wetter, and results in a shorter growing season than points inland. The floristic tension zone as described by Curtis (1959) separates the flora of Wisconsin into two major plant associations, northern and southern. Part of this tension zone running directly north to south from Green Bay to Milwaukee passes to the west of Woodland Dunes. The proximity of the Center to the tension zone is revealed by a mixture of northern and southern species common to Wisconsin major plant associations, the northern hardwoods and the southern prairie-forest. The classification of the vegetation communities at Woodland Dunes according to Curtis (1959) is mesic northern hardwoods and the wet-mesic southern hardwoods.

In a recent study by Kotar & Burger (1996), plant associations were developed for smaller geographic areas in Wisconsin that more closely approximate the plant composition of actual communities. Based on this study, one major plant community comprises the flora of the Woodland Dunes Nature center. It is termed the beech-sugar maple forest with yellow birch and elms, as well as some hemlock and white pine along the Lake Michigan shoreline. These trees represent the common forest canopy or cover types and may also include black cherry. One noticeable omission from the study is its failure to mention or account for the presence of white cedar or black and green ashes which are very common in the swales or wet areas at the Dunes. The understory associated with the Dunes does match to some degree the shrubs and small trees recognized as being part of this community by the above study, those in part being: elderberry, choke cherry, and gooseberries. Further, the wet areas of the dunes are occupied by alders which are not mentioned by the above authors. The ground flora is also similar and as noted reflects the transition between the northern and southern floras of the state. Several southern species of note that are present are enchanter's nightshade, wild geranium, and mayapple. Northern flora types such as partridgeberry, wild lily-of-the valley, and big-leaf aster are typical inhabitants of Woodland Dunes

Taxonomy, Nomenclature and Organization of the Checklist.

Taxonomically, as well as in regard to nomenclatural considerations, this checklist adopts and follows the procedures outlined by Wetter et al. (2001) in the Checklist of Vascular Plants of Wisconsin. The references, resources, manuals, and electronic sources used were mostly identical to those used by Wetter et al.; e.g., Gleason and Cronquist's Manual of Vascular Plants 2nd. ed., 1991; Holmgren's Illustrated Companion to Gleason and Cronquist's Manual, 1998; and Flora of North America, three volumes, (1973, 1997, 2000). A valuable electronic resource that provided considerable information was the UW Wisconsin Herbarium (<http://www.botany.wisc.edu/wisflora>) site. The structure of the Woodland Dunes Nature Center checklist also mirrors or follows, with some ex-

ceptions, the treatment presented in the Wisconsin checklist. In cases where a particular taxon is, according to all resources, a new report for Manitowoc County, this is indicated. The collections for the flora are presently housed at the UW Manitowoc campus and duplicate specimens will be donated to the Woodland Dunes Nature Center.

CHECKLIST

FERNS AND FERN ALLIES:

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn var. *latiusculum* (Desv.) Underw. ex A.Heller; bracken, bracken fern, eastern bracken fern

DRYOPTERIDACEAE

Athyrium filix-femina (L.) Roth ex Mert. var. *angustum* (Willd.) G. Lawson; common lady fern, lady fern, northeastern lady fern, northern lady fern

Cystopteris fragilis (L.) Bernh.; bladder fern, brittle bladder fern, northern fragile fern

Cystopteris laurentiana (Weath.) Blasdell—new report; Laurentian bladder fern, St. Lawrence bladder fern

Cystopteris protrusa (Weath.) Blasdell—new report; creeping fragile fern, lowland bladder fern

Deparia (*Asplenium*) *acrostichoides* (Sw.) M.Kato; silver false spleenwort, silvery glade fern, silvery spleenwort

Dryopteris carthusiana (Vill.) H.P.Fuchs; spinulose wood fern, toothed wood fern

Dryopteris clintoniana (D.C.Eaton) Dowell—new report; Clinton's shield fern, Clinton's wood fern

Dryopteris cristata (L.) A.Gray; crested shield fern, crested wood fern

Dryopteris goldiana (Hook. ex Goldie) A. Gray; giant wood fern, Goldie's fern, Goldie's wood fern

Dryopteris intermedia (Muhl. ex Willd.) A. Gray; fancy wood fern, glandular wood fern, intermediate wood fern

Dryopteris marginalis (L.) A. Gray; marginal shield fern, marginal wood fern

Gymnocarpium dryopteris (L.) Newman; common oak fern, western oak fern

Gymnocarpium robertianum (Hoffm.) Newman; limestone oak fern, scented oak fern

Onoclea sensibilis L.; sensitive fern

EQUISETACEAE

Equisetum hyemale L. subsp. *affine* (Engelm.) Calder & Roy L. Taylor; common scouring rush, pipes, scouring rush horsetail

Equisetum palustre L.—new report; marsh horsetail

Equisetum scirpoides Michx.; dwarf scouring rush, sedge horsetail

Equisetum sylvaticum L.; wood horsetail, woodland horsetail

LYCOPODIACEAE

Diphasiastrum complanatum (L.) Holub—new report; Christmas green, flat-branched club-moss, northern running-pine

Diphasiastrum digitatum (Dill. ex A.Braun) Holub; crowfoot club-moss, southern ground-cedar, southern running-pine, trailing ground-pine

Huperzia lucidula (Michx.) Trevis; shining club-moss, shining fir-moss

Huperzia porophila (F. E. Lloyd & Underw.) Holub—new report; rock club-moss

Lycopodium clavatum L.; running club-moss, running ground-pine, running-pine, staghorn club-moss

Lycopodium dendroideum Michx.—new report; northern tree club-moss, round-branched club-moss

Lycopodium obscurum L.; flat-branched ground-pine, princess'-pine, rare club-moss

OPHIOGLOSSACEAE

- Botrychium lanceolatum* (S. G. Gmel.) Ångstr. subsp. *angustisegmentum* (Pease & A. H. Moore) R. T. Clausen—new report; lance-leaved grape fern, narrow triangle moonwort, triangle grape fern, triangle moonwort
Botrychium matricariifolium (Döll) A. Braun ex W. D. J. Koch—new report; daisy-leaf grape fern, daisy-leaf moonwort, matricary grape fern
Botrychium multifidum (S. G. Gmel.) Rupr.; leathery grape fern, leather-leaved grape fern
Botrychium virginianum (L.) Sw.; rattlesnake fern
Botrychium simplex E. Hitchc.—new report; least moonwort, little grape fern, small grape fern
Ophioglossum pusillum Raf.—new report; adder's-tongue, northern adder's-tongue

OSMUNDACEAE

- Osmunda cinnamomea* L.; cinnamon fern
Osmunda claytoniana L.; interrupted fern
Osmunda regalis L. var. *spectabilis* (Willd.) A. Gray; American royal fern, flowering fern, royal fern

THELYPTERIDACEAE

- Phegopteris connectilis* (Michx.) Watt; narrow beech fern, northern beech fern
Thelypteris noveboracensis (L.) Nieuwl.; New York fern
Thelypteris palustris Schott var. *pubescens* (Lawson) Fernald; eastern marsh fern, marsh fern

GYMNOSPERMS

CUPRESSACEAE

- Juniperus communis* L. var. *depressa* Pursh; common juniper
Thuja occidentalis L.; eastern arborvitae, northern white-cedar

PINACEAE

- Abies balsamea* (L.) Mill.; balsam fir, Canada balsam
Larix laricina (Du Roi) K. Koch; larch, tamarack
Picea glauca (Moench) Voss; white spruce
Pinus banksiana Lambert; jack pine
Pinus resinosa Aiton; Canadian pine, Norway pine, red pine
Pinus strobus L.; eastern white pine
Tsuga canadensis (L.) Carrière; eastern hemlock, hemlock, northern hemlock

TAXACEAE

- Taxus canadensis* Marshall; American yew, Canadian yew, ground-hemlock

ANGIOSPERMS: DICOTYLEDONS

ACERACEAE

- Acer rubrum* L. var. *rubrum*; red maple
Acer saccharum Marshall var. *saccharum*; hard maple, sugar maple
Acer spicatum Lam.; mountain maple

ANACARDIACEAE

- Toxicodendron radicans* (L.) Kuntze subsp. *negundo* (Greene) Gillis; common eastern poison-ivy, poison-ivy
Rhus hirta (L.) Sudworth; staghorn sumac, velvet sumac

APIACEAE

- Carum carvi* L.; caraway
Cicuta maculata L.; common water-hemlock, spotted water-hemlock
Cryptotaenia canadensis (L.) DC.; Canadian honewort, white chervil
Daucus carota L.; Queen Anne's-lace, wild carrot
Osmorhiza claytonii (Michx.) C. B. Clarke; bland sweet cicely, Clayton's sweet-root, hairy sweet cicely

Pastinaca sativa L.; wild parsnip
Sanicula marilandica L.; black snakeroot, Maryland sanicle
Sium suave Walter; hemlock water-parsnip, water-parsnip

APOCYNACEAE

Apocynum androsaemifolium L.; spreading dogbane
Apocynum sibiricum Jacq.—new report; clasping dogbane, Indian hemp

AQUIFOLIACEAE

Illex verticillata (L.) A. Gray; common winterberry

ARALIACEAE

Aralia nudicaulis L.; wild sarsaparilla
Aralia racemosa L.; American spikenard, life-of-man

ASCLEPIADACEAE

Asclepias syriaca L.; common milkweed, silkweed
Asclepias incarnata L. subsp. *incarnata*; swamp milkweed

ASTERACEAE

Achillea millefolium L.; common yarrow, milfoil
Ambrosia psilostachya DC.—new report; perennial ragweed, western ragweed
Antennaria neglecta Greene; cat's-foot, field pussy-toes
Arctium lappa L.—new report; great burdock
Artemisia campestris L. subsp. *caudata* (Michx.) H. M. Hall & Clem; field sage-wort, field wormwood
Aster cordifolius L.; common blue heart-leaved aster, common blue wood aster
Aster lanceolatus Willd. var. *interior* (Wiegand) A. G. Jones—new report; inland panicked aster, panicked aster, white panicle aster
Aster lateriflorus (L.) Britton; calico aster, goblet aster, side-flowering aster
Aster macrophyllus L.; big-leaved aster, large-leaved aster
Aster novae-angliae L.; New England aster
Aster pilosus Willd. var. *pilosus*—new report; awl aster, frost aster, hairy aster, white old-field aster
Aster praealtus Poir.—new report; veiny lined aster, willow aster, willow-leaved aster
Aster puniceus L.; bristly aster, purple-stem aster, swamp aster
Bidens frondosus L.; common beggar-ticks, devil's beggar-ticks
Centaurea biebersteinii DC; spotted knapweed
Cichorium intybus L.; blue-sailors, chicory
Cirsium arvense (L.) Scop.; Canada thistle, creeping thistle, field thistle
Cirsium vulgare (Savi) Ten.; bull thistle
Coreopsis lanceolata L.; lance-leaf tickseed, long-stalk tickseed, sand coreopsis, sand tickseed
Coreopsis tinctoria Nutt. var. *tinctoria*—new report; golden tickseed, plains tickseed
Erigeron annuus (L.) Pers; annual fleabane, eastern daisy fleabane
Erigeron philadelphicus L.; common fleabane, marsh fleabane, Philadelphia daisy
Erigeron pulchellus Michx. var. *pulchellus*—new report; Robin's-plantain
Erigeron strigosus Muhl. ex Willd. var. *strigosus*; daisy fleabane, prairie fleabane, rough fleabane
Eupatorium perfoliatum L. var. *perfoliatum*; boneset, common boneset, thoroughwort
Eupatorium maculatum L. subsp. *maculatum*; spotted Joe-Pye-weed
Euthamia graminifolia (L.) Nutt. var. *graminifolia*; common flat-topped goldenrod, grass-leaved goldenrod
Gnaphalium obtusifolium L. var. *obtusifolium*; cat's-foot, fragrant cudweed, old-field-balsam, old-field cudweed, rabbit-tobacco
Hieracium aurantiacum L.; devil's-paintbrush, grim-the-coller, orange hawkweed, red daisy
Lactuca biennis (Moench) Fernald; tall blue lettuce, woodland lettuce
Lactuca canadensis L.; Canada lettuce, tall lettuce, tall wild lettuce, wild lettuce
Leucanthemum vulgare Lam.; common daisy, field daisy, marguerite, ox-eye daisy

Packera pseud aurea (Rydb.) W. A. Weber & A. Löve var. *semicordata* (Mack. & Bush) D. K. Trock & T. M. Barkley—new report; false-gold groundsel, heart-leaved groundsel, western golden ragwort

Prenanthes alba L.; lion's-foot, rattlesnake-root, white-lettuce

Rudbeckia hirta L. var. *pulcherrima* Farw.; black-eyed Susan

Solidago canadensis L. var. *canadensis*—new report; Canadian goldenrod, common goldenrod

Solidago juncea Aiton; early goldenrod

Solidago nemoralis Aiton subsp. *nemoralis*; dyer's-weed goldenrod, field goldenrod, gray goldenrod, old-field goldenrod

Solidago patula Muhl. ex Willd. var. *patula*—new report; rough-leaved goldenrod, round-leaved goldenrod, swamp goldenrod

Sonchus arvensis L. var. *arvensis*—new report; field sow-thistle, perennial sow-thistle

Sonchus arvensis L. var. *glabrescens* Günther, Grab. & Wimm.; marsh sow-thistle

Tragopogon dubius Scop.; fistulous goat's-beard, greater sand goat's-beard, yellow salsify

BALSAMINACEAE

Impatiens capensis Meerb; orange jewelweed, orange touch-me-not, spotted touch-me-not

BERBERIDACEAE

Podophyllum peltatum L.; May-apple, wild mandrake

Berberis thunbergii DC; Japanese barberry

BETULACEAE

Alnus incana (L.) Moench subsp. *rugosa* (Du Roi) R. T. Clausen; mountain alder, speckled alder, swamp alder

Betula alleghaniensis Britton; yellow birch

Betula papyrifera Marshall; canoe birch, paper birch, white birch

BORAGINACEAE

Echium vulgare L.; blueweed, common viper's-bugloss, viper's-bugloss

Myosotis scorpioides L.; common forget-me-not, forget-me-not, true forget-me-not, water scorpion-grass

BRASSICACEAE

Armoracia rusticana P. Gaertn., B. Mey. & Scherb; horseradish

Barbarea vulgaris R. Br; garden yellow-rocket, winter-ress, yellow-rocket

Berteroa incana (L.) DC; hoary false madwort, hoary-allysum

Capsella bursa-pastoris (L.) Medik.; shepherd's-purse

Cardamine bulbosa (Schreb. ex Muhl.) Britton, Sterns & Poggenb.; spring-ress

Cardamine diphylla (Michx.) A. W. Wood; broad-leaved toothwort, crinkle-root

Cardamine pratensis L. var. *palustris* Wimm. & Grab; cuckoo-flower

Erysimum cheiranthoides L.; worm-seed mustard, worm-seed wallflower

Lepidium densiflorum Schrad. var. *densiflorum*—new report; prairie pepper-weed, small peppergrass

Rorippa palustris (L.) Besser; bog yellow-ress, common yellow-ress

Thlaspi arvense L.; field pennycress

CAMPANULACEAE

Campanula aparinoides Pursh var. *aparinoides*—new report; marsh bellflower

Campanula rapunculoides L.; creeping bellflower, European bellflower, rampion bellflower, rover bellflower

CAPRIFOLIACEAE

Diervilla lonicera Mill; northern bush-honeysuckle

Lonicera dioica L. var. *dioica*; limber honeysuckle, mountain honeysuckle, red honeysuckle

Lonicera morrowii A. Gray; Asian fly honeysuckle, Morrow's honeysuckle

Lonicera reticulata Raf.—new report; grape honeysuckle, yellow honeysuckle

Lonicera tatarica L.; Tartarian honeysuckle

Sambucus canadensis L. var. *canadensis*; American elder, elderberry

Sambucus racemosa L. subsp. *pubens* (Michx.) House; red elderberry, red-berried elder, scarlet elderberry

Viburnum acerifolium L.; dockmackie, maple-leaved arrow-wood, maple-leaved viburnum

CARYOPHYLLACEAE

Cerastium fontanum Baumg. emend Jalas subsp. *vulgare* (Hartm.) Greuter & Burdet; big mouse-ear chickweed, common chickweed, common mouse-ear, mouse-ear chickweed

Silene latifolia Poir. subsp. *alba* (Mill.) Greuter & Burdet; bladder campion, white campion, white cockle

Spergula arvensis L.—new report; corn spurry

Stellaria aquatica (L.) Scop.; giant chickweed, water chickweed

Stellaria longifolia Muhl. ex Willd. var. *longifolia*; long-leaved stitchwort

CHENOPODIACEAE

Chenopodium album L.; common lamb's-quarters, lamb's-quarters, pigweed

CORNACEAE

Cornus amomum Mill. var. *schuetzeana* (C. A. Mey.) Rickett; blue-fruited dogwood, silky dogwood

Cornus canadensis L.; bunchberry, bunchberry dogwood, dwarf cornel

Cornus stolonifera Michx.; red osier dogwood

Cornus rugosa Lam.; round-leaved dogwood

CUCURBITACEAE

Echinocystis lobata (Michx.) Torr. & A. Gray; balsam-apple, wild-cucumber

FABACEAE

Lathyrus palustris L.; marsh pea, marsh vetchling, slender-stem pea-vine

Medicago lupulina L.; black medick

Medicago sativa L.; alfalfa

Melilotus alba Medik.; white sweet-clover

Melilotus officinalis (L.) Lam.; yellow sweet-clover

Trifolium aureum Pollich—new report; golden clover, palmate hop clover, yellow hop clover

Trifolium hybridum L.; alsike clover

Trifolium pratense L.; red clover

Trifolium repens L.; white clover

Vicia americana Muhl. ex Willd. subsp. *americana*; American vetch

FAGACEAE

Fagus grandifolia Ehrh.; American beech, beechnut

GENTIANACEAE

Centaurium pulchellum (Sw.) Druce; branching centaur, showy centaur

Gentiana andrewsii Griseb. var. *andrewsii*; Andrews' gentian, bottle gentian, prairie closed gentian

GERANIACEAE

Geranium maculatum L.; Crane's-bill, spotted geranium, wild geranium

GROSSULARIACEAE

Ribes triste Pall.; swamp red currant

Ribes americanum Miller; American black currant, eastern black currant, wild black currant

HYDRANGEACEAE

Philadelphus coronarius L.; European mock-orange, sweet mock-orange

HYPERICACEAE

Hypericum majus (A. Gray) Britton; larger Canadian St. John's-wort

Hypericum perforatum L.; common St. John's-wort, Klamath-weed, St. John's-wort

LAMIACEAE

Galeopsis tetrahit L.; brittle-stem hemp-nettle, common hemp-nettle, hemp-nettle

Glechoma hederacea L.; creeping-Charlie, gill-over-the-ground, ground-ivy

Lycopus americanus Muhl. ex W. P. C. Barton; American water-horehound, common water-horehound

Lycopus uniflorus Michx.; northern bugleweed, northern water-horehound

Mentha arvensis L. var. *canadensis* (L.) Kuntze; field mint, wild mint

Mentha ×gracilis Sole (pro sp.)—new report; little-leaved mint, red mint

Mentha longifolia (L.) Huds.—new report; horse mint, wavy mint

Monarda fistulosa L. subsp. *fistulosa*; bee balm, wild bergamot

Nepeta cataria L.; catnip

Prunella vulgaris L. subsp. *lanceolata* (W. P. C. Barton) Hultén; lance self-heal

Scutellaria galericulata L.; common skullcap, marsh skullcap

Scutellaria lateriflora L.; blue skullcap, mad-dog skullcap

Stachys palustris L. subsp. *palustris*—new report; hedge-nettle, marsh hedge-nettle, wound-wort

Stachys tenuifolia Willd. var. *tenuifolia*; narrow-leaved hedge-nettle, smooth hedge-nettle

LOBELIACEAE

Lobelia spicata Lam. var. *spicata*—new report; pale-spike lobelia, spiked lobelia

Lobelia inflata L.; Indian-tobacco

MONOTROPACEAE

Monotropa uniflora L.; Indian-pipe

OLEACEAE

Fraxinus nigra Marshall; black ash

Fraxinus pennsylvanica Marshall; green ash, red ash

ONAGRACEAE

Circaea alpina L. subsp. *alpina*; alpine enchanter's-nightshade, northern enchanter's-nightshade, small enchanter's-nightshade

Circaea lutetiana L. subsp. *canadensis* (L.) Asch. & Magnus; broad-leaf enchanter's-nightshade

Epilobium angustifolium L. subsp. *circumvagum* Mosquin; fireweed, great willow-herb

Epilobium ciliatum Raf. subsp. *ciliatum*; American willow-herb, coast willow-weed, hairy willow-herb

Epilobium leptophyllum Raf.; American marsh willow-herb, bog willow-herb, fen willow-herb

Oenothera biennis L.; bastard evening-primrose, common evening-primrose

Oenothera parviflora L.; northern evening-primrose, small-flowered evening-primrose

OROBANCHACEAE

Epifagus virginiana (L.) W. P. C. Barton; beech-drops, cancer-root

OXALIDACEAE

Oxalis corniculata L.—new report; creeping yellow wood-sorrel

Oxalis montana Raf.; mountain wood-sorrel

Oxalis dillenii Jacq.—new report; Dillenius' oxalis, southern yellow wood-sorrel

PLANTAGINACEAE

Plantago major L.; broad-leaved plantain, common plantain, plantain

Plantago rugelii Decne.; American plantain, black-seeded plantain, red-stalked plantain, Rugel's plantain

POLYGALACEAE

Polygala sanguinea L.—new report; blood milkwort, field milkwort, purple milkwort

Polygala paucifolia Willd; flowering-wintergreen, fringed polygala, gay-wings

POLYGONACEAE

Polygonum amphibium L. var. *stipulaceum* N. Coleman; water heart's-ease, water smartweed

Polygonum aviculare L.; common knotweed, prostrate knotweed

Polygonum convolvulus L.; black-bindweed, false buckwheat

Polygonum persicaria L.; heart's-ease, spotted lady's-thumb

Polygonum sagittatum L.—new report; arrow-leaved tear-thumb

- Rumex acetosella* L.; common sheep sorrel, field sorrel, red sorrel, sheep sorrel
Rumex crispus L.; curly dock, sour dock
Rumex orbiculatus A. Gray—new report; great water dock

PORTULACACEAE

- Claytonia virginica* L. var. *virginica*; spring-beauty, Virginia spring-beauty

PRIMULACEAE

- Lysimachia thyrsiflora* L.; swamp loosestrife, tufted loosestrife
Trientalis borealis Raf. subsp. *borealis*; American starflower

PYROLACEAE

- Orthilia secunda* (L.) House; one-sided shin-leaf, one-sided wintergreen
Pyrola asarifolia Michx. subsp. *asarifolia*; liver-leaf wintergreen, pink shin-leaf
Pyrola elliptica Nutt.; elliptic shin-leaf, large-leaved shin-leaf, wax-flower shin-leaf
Pyrola rotundifolia L. subsp. *americana* (Sweet) R. T. Clausen; round-leaved shin-leaf

RANUNCULACEAE

- Actaea rubra* (Aiton) Willd.; red baneberry
Anemone quinquefolia L. var. *quinquefolia*; nightcaps, wood anemone
Anemone canadensis L.; Canada anemone, Canadian anemone, meadow anemone
Caltha palustris L.; cowslip, marsh-marigold, yellow marsh-marigold
Clematis virginiana L.; devil's-darning-needle, virgin's-bower
Coptis trifolia (L.) Salisb.; three-leaved gold-thread
Ranunculus abortivus L.; little-leaf buttercup, small-flowered buttercup
Ranunculus acris L.; common buttercup, blister plant, meadow buttercup, tall buttercup
Ranunculus hispidus Michx.; bristly buttercup, hispid buttercup, rough buttercup
Ranunculus recurvatus Poir. var. *recurvatus*; blisterwort, hooked buttercup
Thalictrum dasycarpum Fisch. & Avé-Lall; purple meadow-rue, tall meadow-rue

ROSACEAE

- Agrimonia gryposepala* Wallr.; common agrimony, tall hairy agrimony
Amelanchier laevis Wiegand; Allegheny serviceberry, Allegheny shadblow, smooth serviceberry
Amelanchier sanguinea (Pursh) DC. var. *sanguinea*; low shadblow, New England serviceberry, round-leaved serviceberry
Argentina anserina (L.) Rydb.; silver-weed
Fragaria virginiana Duchesne; thick-leaved wild strawberry, Virginia strawberry, wild strawberry
Geum aleppicum Jacq.; yellow avens
Geum canadense Jacq.; white avens
Geum rivale L.; purple avens, water avens
Potentilla norvegica L.; Norwegian cinquefoil, rough cinquefoil, strawberry-weed
Potentilla simplex Michx.; common cinquefoil, old-field five-fingers, old-field cinquefoil
Potentilla recta L.; rough-fruited cinquefoil, sulphur cinquefoil, sulphur five-fingers
Prunus serotina Ehrh.; wild black cherry
Prunus virginiana L. var. *virginiana*; chokecherry
Rosa blanda Aiton; early wild rose, smooth rose, wild rose
Rosa multiflora Thunb. ex Murray; multiflora rose
Rubus allegheniensis Porter ex L. H. Bailey var. *allegheniensis*; Allegheny blackberry, common blackberry
Rubus idaeus L. var. *strigosus* (Michx.) Maxim.; American red raspberry, red raspberry, wild red raspberry
Rubus pubescens Raf.; dwarf red raspberry
Sorbus aucuparia L.; Eurasian mountain-ash, European mountain-ash, rowan
Spiraea alba Du Roi var. *alba*; white meadowsweet

RUBIACEAE

- Galium aparine* L.; annual bedstraw, cleavers, goose-grass, sticky-willy
Galium tinctorium L.; southern three-lobed bedstraw, stiff bedstraw

Galium trifidum L. subsp. *trifidum*; northern three-lobed bedstraw, small bedstraw
Galium triflorum Michx.; fragrant bedstraw, sweet-scented bedstraw
Mitchella repens L.; partridgeberry

SALICACEAE

Populus balsamifera L. subsp. *balsamifera*; balsam poplar, hackmatack
Populus deltoides Bartram ex Marshall subsp. *monilifera* (Aiton) Eckenwald; plains cottonwood
Populus grandidentata Michx.; big-tooth aspen, large-toothed aspen
Populus tremuloides Michx.; aspen, quaking aspen
Salix nigra Marshall—new report; black willow

SAXIFRAGACEAE

Mitella diphylla L.; bishop's-cap, two-leaf miterwort
Mitella nuda L.; naked miterwort, small bishop's-cap
Penthorum sedoides L.—new report; ditch stonecrop

SCROPHULARIACEAE

Agalinis tenuifolia (Vahl) Raf.; common agalinis, common false foxglove
Chelone glabra L.; turtlehead, white turtlehead
Chelone obliqua L.; purple turtlehead, red turtlehead
Linaria vulgaris Miller; butter-and-eggs
Mimulus ringens L. var. *ringens*; Allegheny monkey-flower, monkey-flower
Verbascum thapsus L.; common mullein, flannel plant, giant mullein
Veronica peregrina L.; neck-weed, purslane speedwell
Veronica scutellata L.; marsh speedwell, narrow-leaved speedwell, skullcap speedwell

SOLANACEAE

Solanum dulcamara L.; bittersweet nightshade, climbing nightshade, deadly nightshade

URTICACEAE

Urtica dioica L. subsp. *gracilis* (Aiton) Solander; stinging nettle

VALERIANACEAE

Valeriana officinalis L.—new report; garden-heliotrope, garden valerian

VERBENACEAE

Verbena hastata L.; blue vervain, simpler's-joy, swamp verbena

VIOLACEAE

Viola blanda Willd. var. *palustriformis* A. Gray; sweet white violet
Viola canadensis L. var. *canadensis*; Canadian white violet, tall white violet
Viola cucullata Aiton; blue marsh violet, hooded violet, marsh blue violet
Viola pubescens Aiton var. *pubescens*—new report; downy yellow violet, yellow forest violet, yellow violet

VITACEAE

Parthenocissus quinquefolia (L.) Planch; Virginia creeper, woodbine
Vitis riparia Michx.; frost grape, river bank grape

ANGIOSPERMS: MONOCOTYLEDONS

ALISMACEAE

Alisma subcordatum Raf.; American water-plantain, common water-plantain, southern water-plantain
Sagittaria latifolia Willd. var. *latifolia*; broad-leaved arrowhead, common arrowhead, wapato

ARACEAE

Arisaema triphyllum (L.) Schott subsp. *triphyllum*; Indian turnip, Jack-in-the-pulpit
Calla palustris L.; water-arum, wild calla
Symplocarpus foetidus (L.) Salisb. ex W. P. C. Barton; skunk-cabbage

CYPERACEAE

- Carex aurea* Nutt.; elk sedge, golden sedge, golden-fruited sedge
Carex arctata Boott ex Hooker; drooping woodland sedge
Carex canescens L.; gray bog sedge, silvery sedge
Carex communis L. H. Bailey var. *communis*; colonial oak sedge, fibrous-root sedge
Carex emoryi Dewey ex Torr; Emory's sedge
Carex gracillima Schwein.; graceful sedge, purple-sheathed graceful sedge
Carex hirta L.—new record; hammer sedge, sharp-toothed woolly sedge
Carex intumescens Rudge; greater bladder sedge, shining bur sedge, swollen sedge
Carex lacustris Willd.; common lake sedge, rip-gut sedge
Eleocharis acicularis (L.) Roem. & Schult.—new record; needle spike-rush
Eleocharis compressa Sull. var. *compressa*—new record; flat-stemmed spike-rush
Eleocharis elliptica Kunth—new record; elliptic spike-rush

IRIDACEAE

- Iris virginica* L. var. *shrevei* (Small) E. S. Anderson; blue flag, Shreve's iris, southern blue flag, Virginia iris
Sisyrinchium albidum Raf.—new record; common blue-eyed-grass, pale blue-eyed-grass, white blue-eyed-grass
Sisyrinchium montanum Greene subsp. *montanum*; mountain blue-eyed-grass, strict blue-eyed grass

JUNCACEAE

- Juncus bufonius* L.; toad rush
Juncus dudleyi Wiegand; Dudley's rush
Juncus filiformis L.—new record; thread rush
Luzula acuminata Raf. var. *acuminata*; hairy wood rush

LILIACEAE

- Allium tricoccum* Aiton; wild leek
Asparagus officinalis L.; asparagus, garden asparagus
Clintonia borealis (Aiton) Raf.; yellow blue-bead-lily
Erythronium americanum Ker-Gawl; American trout-lily, yellow dog-tooth violet, yellow trout-lily
Lilium michiganense Farw.; Michigan lily, Turk's-cap lily
Maianthemum canadense Desf.; Canada bead-ruby, Canada mayflower, wild lily-of-the-valley
Polygonatum pubescens (Willd.) Pursh; downy Solomon's-seal, hairy Solomon's-seal
Smilacina racemosa (L.) Desf. var. *racemosa*; false Solomon's-seal, false spikenard
Streptopus amplexifolius (L.) DC. var. *americanus* Schult.; clasp-leaf twisted-stalk, twisted-stalk, white mandarin
Streptopus roseus Michx. var. *longipes* (Fernald) Fassett; rosy twisted-stalk
Trillium cernuum L.; nodding trillium, whip-poor-will flower

ORCHIDACEAE

- Corallorhiza trifida* Châtel; early coralroot, northern coralroot, yellow coralroot
Corallorhiza maculata (Raf.) Raf.; spotted coralroot, summer coralroot
Cypripedium acaule Aiton; moccasin-flower, pink lady's-slipper
Cypripedium reginae Walter; showy lady's-slipper
Epipactis helleborine (L.) Crantz; helleborine, helleborine orchid
Liparis loeselii (L.) Rich.; fen orchid, green twayblade, Loesel's twayblade
Malaxis unifolia Michx.; green adder's-mouth
Platanthera huronensis (Nutt.) Lindl.; Huron green orchid, tall northern bog orchid
Platanthera hyperborea (L.) Lindl.—new record; northern green orchid, tall northern bog orchid
Platanthera lacera (Michx.) G. Don—new record; green fringed orchid, ragged fringed orchid
Platanthera obtusata (Banks ex Pursh) Lindl.; blunt bog orchid, blunt-leaved orchid
Platanthera psycodes (L.) Lindl.; lesser purple fringed orchid

- Spiranthes cernua* (L.) Rich.; nodding lady's-tresses
Spiranthes romanzoffiana Cham.—new record; hooded lady's-tresses

POACEAE

- Agrostis stolonifera* L.; creeping bent grass, creeping tickle grass
Alopecurus pratensis L.—new record; meadow foxtail
Elymus trachycaulus (Link) Gould ex Shinnars; slender wheat grass
Oryzopsis asperifolia Michx.; rough-leaved rice grass
Poa compressa L.; Canada bluegrass, wiregrass

TYPHACEAE

- Typha latifolia* L.; broad-leaved cat-tail, common cat-tail

ACKNOWLEDGMENTS

I acknowledge and thank the UW Colleges Grants Committee and UW Manitowoc Professional Development Committee for awards that provided assistance for this project over the years. I especially thank other parties, UW-Manitowoc College faculty and staff, students, and my family for their efforts on my behalf. Finally, a special thanks to the staff and personnel at Woodland Dunes for their support

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BOOK REVIEWS

Coyle, Heather M. (ed.). 2005. *Forensic Botany: Principles and Applications to Criminal Casework*. CRC Press LLC, Boca Raton, FL, 318 pp. ISBN 0-8493-1529-8 (Hardbound). \$119.95

Over the past year, Crime Scenes Investigations (CSI) TV shows have leapt to the fore-front for American viewing. Classes on forensics are popping up on many college and university campuses. Over the past 20 years there has been, with the advent of DNA analyses, a boom in the use of biological evidence.

Numerous samples of biological based material can be characterized and identified to precise individuals. This area of forensic science has had a major impact on all aspects of standard procedures and practices, validation, quality of science, and education. Much of what is portrayed on the TV programs centers around human forensics, but one area that can have a dramatic impact on a case is botanical information. This volume attempts to introduce the reader into this area. It is written for the non-professional botanist.

The book is a compilation of review articles written by 20 contributors from Australia, England, New Zealand, Taiwan, and the United States, all apparently specialists in their field of botanical forensics (biographies are given in Appendix D). The editor, Dr. Heather Miller Coyle, is presently the lead criminalist for the Division of Scientific Services in Connecticut and is a specialist in DNA testing for human and non-human evidence.

There are 15 chapters with eight written completely or partially by Coyle. The first four chapters are very introductory and cover such topics as basic plant biology, plant cell structure and function, reproduction, genetics, DNA structure, and basics of molecular biology (Chapters 1–5). In Chapter 6, Coyle deals with plant diversity and gives various “Case Histories” of tracking the history of grape cultivars, the potato, rice, and maize (corn). There is also discussion of various markers used in unraveling mysteries.

Chapter 7 summarizes the use of botanical and biological evidence in criminal investigations, concluding with two case studies. Chapter 8 gives an overview of the historical developments in using DNA. Chapters 9 and 10 center on identifying plant species by using DNA, especially if the material has been mixed with other contaminants like stomach contents, other plant material, or of a size difficult to identify otherwise.

Chapter 11 deals with some classic forensic botany cases such as anatomical evidence from the first “Trial of the Century,” the kidnapping of Charles Lindbergh’s son, the 1991 Connecticut case where pond microscopic plants on clothes tied attackers to an attempted murder, the use of pollen samples to solve cases, forensic archeology in burial sites, and others. Chapter 12 discusses tracking clonally propagated marijuana, and Chapter 13 deals with the legal aspects and acceptance by courts of new forensic methods.

Chapter 14 deals, more in depth than the other chapters, with palynology

(pollen analysis). Here are the best illustrations of the entire book and also some color to emphasize points made about the stages of meiosis and mitosis. The micrographs of light and scanning electron microscopy (SEM) of pollen are superb and certainly give the reader an understanding of pollen features helpful in identification to plant species. It ends with some interesting case studies.

The final Chapter 15 looks to the future of forensic botany and where DNA typing technologies of plants might lead, especially forensic plant genotyping. Each chapter has a selected list of references at the end. There are four appendices: Appendix A: Considerations for the Use of Forensic Botanical Evidence: An Overview; Appendix B: Glossary of Terms (covers nine pages); Appendix C: Directory of Contacts (may be helpful to those involved in forensics); and Appendix D mentioned above.

The book is small in size at 6×9 " (16×25 cm), printed on acid-free paper, and with some figures and photographs in most chapters. Except for the outstanding ones mentioned above, most photos are on the dark side and of poor quality. At a price of \$100+ the book will have limited personal sales. On the positive side, it does give the enquiring person an introduction to forensic botany. The varied case studies given between its covers may make the book of value to most college or municipal libraries.

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Mohar, P. (ed.). 2000. *A Congenial Fellowship. A Botanical Correspondence between Charles C. Deam and Floyd A. Swink. 1946–1951*. Shirley Heinze Environmental Fund, 444 Barker Road, Michigan City, IN 46304, 387 pp. ISBN 0-7388-2572-7 (Softbound), \$18.00 (<http://www.heinzetrust.org/>).

The two central figures of this book are amateur botanists who contributed greatly to the understanding of wild plants in the Great Lakes area. Charles C. Deam, who wrote, in the opinion of the late Dr. Richard Pohl of Iowa State University, "one of the best state floras," the *Flora of Indiana* in 1940, and Floyd A. Swink co-author of *Flora of the Chicago Region*, 4th edition, with Gerald Wilhelm, 1994. These two heroes of Indiana plants laid the groundwork for the rest of us to build upon. These letters allow us to peer into the minds and to follow the collecting trips of two giants of 20th century natural history in northwest Indiana. They also provide a glimpse into the life and times of these two very interesting, dedicated botanists.

Peg Mohar edited this compilation of the letters and notes that passed between these men, largely after Deam retired, and at the beginning of Swink's ac-

tive work on the flora of northwestern Indiana, which formed the basis for the first edition of his flora.

The information comes from typed, double-sided copies in Swink's files, which he was most willing to share, help edit, and contribute to right up until his death, at age 79 on 2 August 2000. The letters began on 5 January 1947 when Deam was 81 and continued until 1951, two years before his death. Some are lengthy and deal with observations about northwest Indiana plants where both authors use Latin names in their discussions. This certainly reflected their botanical understanding, that a "common name" was an inferior way to properly communicate scientific information. At the end of each letter, footnotes have been added to better explain the content.

There are only seven pictures in the book. Two noteworthy photographs show Deam sitting and eating breakfast in the field by his "weed wagon," and Swink standing by Senator Paul Douglas, who along with Swink was helpful in getting the Indiana dunes preserved and set aside as a National Lake Shore.

The ten page Introduction by Barbara Plampin gives the background and history of these two men, and it is a must to fully understand the meaning of the letters in the Letters chapter, which takes up pages 25–342. A short three page (343–345) Afterword, gives some of the testimonials spoken at the memorial service for Floyd Swink on 7 August 2000. Two Indexes are provided at the end: a Plant Index, which gives common and Latin names of plants mentioned in the text; and a General Index with all the names of individuals, localities, and geographical regions mentioned in the letters. A fold out map of the "South Lake Michigan Region—1950" is attached within the back cover.

Those interested in the history of botanizing during the mid-twentieth century will find this an interesting book to read.

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THE BIG TREES AND SHRUBS OF MICHIGAN

39. *Morus alba* L. var. *pendula* Dippel

Weeping White Mulberry

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The largest known Weeping White Mulberry in Michigan is located northeast of South Haven in Allegan County in the southwest part of the Lower Peninsula.

Description of the species: The Mulberries belong to the family Moraceae. Other Michigan representatives of this family include the Red Mulberry (*Morus rubra* L.), the White Mulberry (*Morus alba* L., introduced from China), and the Osage-orange (*Maclura pomifera* (Raf.) Schneider, introduced from the region of Arkansas and Oklahoma). The family is characterized by the production of milky juice and multiple fruits, which are fruits made from an entire pistillate inflorescence rather than from just a single flower. The family is mostly tropical or sub-tropical and includes such well known plants as hops, figs, breadfruits, and *Cannabis* (both hemp and marijuana).

There are two kinds of mulberries in Michigan, red and white. Both types have variously lobed leaves (see Fig. 1). Red mulberries are infrequently seen and can be recognized by the pale and downy hairs of their leaf undersides and the long-attenuate leaf tip. White mulberry leaves are glabrous on both sides but may have pubescence along the main veins on the underside and the tips of the leaves (or lobes, if any) are blunt or barely pointed. White mulberries were introduced to help establish a silk industry in the United States, because their leaves are the preferred food of silkworms. The white mulberry has given rise to many horticultural varieties (Dirr, 1983), one of which, *Morus alba* var. *pendula* has thin, hanging or pendulous branches, frequently cascading in tangled masses to the ground.

Location of Michigan's Big Tree: The largest known Weeping White Mulberry in Michigan is located on the Elmhurst Farm, the Centennial Farm of Mr. and Mrs. Richard Barden. They operate a bed-and-breakfast known as the Elmhurst Inn (269. 637. 4633) in their farmhouse. The tree's site can be reached by taking I-96 north from South Haven (Exit 20) to 109th St. (Exit 26). Turn right onto 109th St. and go approximately 3.0 miles to 64th Street. Turn right and go 1.3 miles to the Elmhurst Farm sign in the front yard on the west side of the road and turn into the driveway to the house and barn. It is 0.3 mi. south of the Leisure intersection on 64th St. The tree is located near the house and barn. If you visit it, please call first. The GPS coordinates for this location are N 42° 27.871' by W 86° 10.114'.

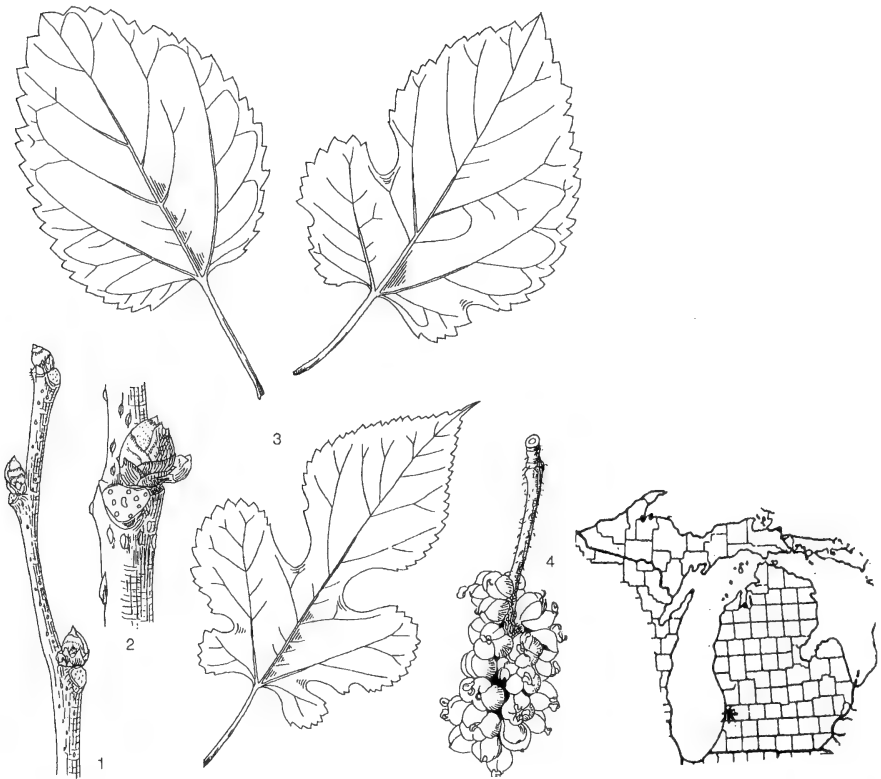


FIGURE 1. Characteristics of the Weeping White Mulberry and location of Michigan's Big Tree. The asterisk on the map indicates the location of Michigan's Big Tree. The drawings are from Barnes & Wagner (1983). 1. Winter twig, $\times 1$. 2. Portion of twig, $\times 2$. 3. Leaves, $\times \frac{3}{4}$. 4. Fruit, multiple of drupes, $\times 2$.

Description of Michigan's Big Tree: The tree has a single solid, healthy trunk. Its girth at $4\frac{1}{2}$ feet above the ground was 60" (5', 1.56 m, diameter = 19.1"). The tree was 20' (6.1 m) high. The average crown spread was 16' (4.9m). The crown consisted of a tangled mass of thin branches cascading to the ground. The tree was fruiting very heavily when measured on 28 June 2003. The total points for this tree are $60 + 20 + \frac{1}{4} \times 16 = 64$.

INVITATION TO PARTICIPATE

If you would like to join in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B. Ehrle

for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property. For the most recent list of Michigan's Big Trees see Ehrle (2003).

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BOOK REVIEW

Albert, Dennis A. 2003. *Between Land and Lake: Michigan's Great Lakes Coastal Wetlands*. Michigan Natural Features Inventory, Stevens T. Mason Building, P.O. Box 30444, Lansing, Michigan 48909-7944. Report #2003-22; enclose personal check for US\$3.00. Order form at web4.msue.msu.edu/mnfi/pub/publications.cfm; also available at that site as a downloadable PDF, *gratis*. 96 pp.; ISBN 1-56525-018-4

As an aspiring botanist and Master's degree student, living and working in Michigan for several decades, I purchased this book to gain information about distinguishing the types of Great Lakes coastal wetlands in Michigan. At this price, I was not really expecting what I received.

Michigan's coastal wetlands are delineated and described using a holistic ecological approach. There are over 50 high-quality color photographs and 20 color diagrams that are skillfully used throughout the 96 pages to make the text come alive. The wetland plants are nicely detailed, and the information and photographs included on the invertebrates, fish, mammals, birds, history, invasive species, as well as information on delineating the different types of Michigan's coastal wetlands, is amazing considering the size of the book. In addition, a discussion on water fluctuations on the Great Lakes and the impact on plant growth (which has certainly been a hot topic in the Great Lakes region recently) makes the book even more worthwhile. Inserts on waterfowl by Greg Soulliere, and plankton by Sheila McNair and Vanessa Lougheed, added dimension to the book.

The reference material in the back of the book includes maps of the "Marshes in Michigan" and a table that details the type and the location of each marsh and whether or not it is open to the public. All the species referenced in the text are listed in the back with both common and Latin names, and the suggested reading list at the end adds a nice touch. Some most interesting and important information is provided in the restoration and recovery section where the author outlines different strategies (some successful and some not so successful) that have been used to restore impacted wetlands, and he also includes a case history of the River Raisin Marsh.

I see this book as an excellent resource for professionals involved in biology, botany, ecology, or resource management, as well as an excellent leisurely read for those interested in wetlands. If you don't already have a copy, get one, it is an incredible deal!

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POWERS BLUFF: A BOTANICALLY SIGNIFICANT SITE IN CENTRAL WISCONSIN

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ABSTRACT

Powers Bluff Maple Woods, a Research Natural Area in Wood County, Wisconsin, is a significant reservoir of pre-European indigenous flora, as well as an important historical and cultural resource. Baseline vegetation data were gathered in this 70-acre southern mesic forest to determine community diversity, evenness, and richness. Four strata including overstory trees, understory trees, shrubs, and herbaceous layer were sampled in the spring and late summer of 2000. Vegetation is described using frequency, density, basal area, percent cover, and importance value. Although spring ephemerals contributed little (5.8% of all species) to the richness of the spring herb layer, total spring flora richness was higher at this site than heretofore reported for similar forest types. Sorensen's similarity index between sampling periods was 0.80, with more species unique to the late summer period (31) than to the spring period (15). Total species richness of the herbaceous layer (both sampling periods = 136 species) is 1.5–3.5 times richer than values reported in other studies of mesic deciduous forests. The bluff's location within the tension zone, a range of site conditions, and identification of all plants to species level may explain this high richness level. Though invasive species were noted on nearby edges and linear fractures (road corridors), no exotic species were encountered in our sampling of the interior of the natural area.

INTRODUCTION

Powers Bluff Maple Woods is a State Natural Area. One of the purposes of State Natural Areas in Wisconsin is to preserve areas of notable scientific value that house an important reservoir of the state's biological diversity [95-96 Wisconsin Statutes 23.27]. We recently completed a thorough quantitative floristic inventory of Powers Bluff.

Powers Bluff (lat. 44° 31' 48"N, long. 090° 04' 21"W; sections 29 and 30, T24N, R4E, Wood County) is a promontory in central Wisconsin rising 91 meters above the surrounding landscape. The State Natural Area on the bluff contains primarily southern mesic forest (SMF, *sensu* Curtis 1959), the ecotone between the boreal forests of the north and the eastern deciduous forests of the south (Curtis 1959). Due to its location in the northern part of the tension zone

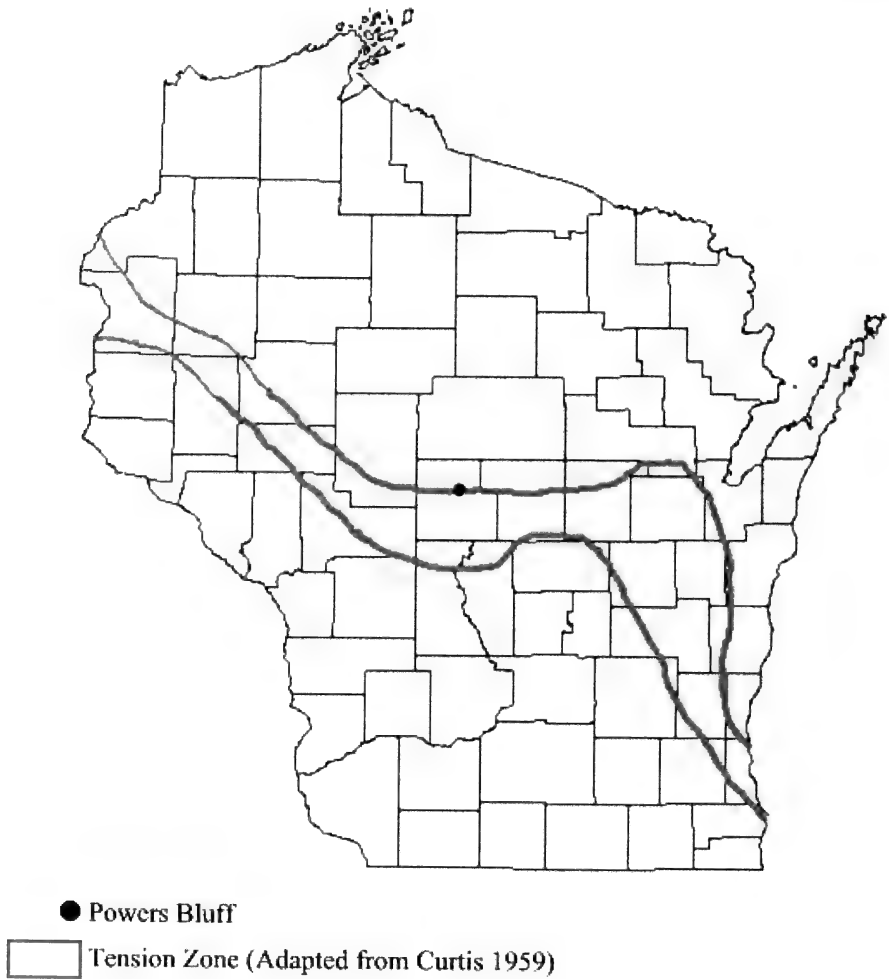


FIGURE 1. Approximate location of Powers Bluff and the Tension Zone (sensu Curtis 1959).

(Figure 1), Powers Bluff houses an unusual assemblage of plants from the northern and southern biomes.

Site Description

Powers Bluff is what remains of a 1.6 billion year old quartzite mountain (Schultz 1986; LaBerge 1994) that was not buried in thick accumulations of glacial drift during the last glacial excursion (Schultz 1986). Today Powers Bluff stands 91 meters above the surrounding glacial plains and 451 meters above sea level (Schultz 1986, Figure 2).

The soils of Powers Bluff contain two different soil series: the Rietbrock silt loam (Re) and Fenwood silt loam (Ff) (Soil Survey of Wood County 1977). The



FIGURE 2. Powers Bluff rising above the surrounding plains. Photographed from west of the bluff by Thomas Willems, Central Wisconsin Archaeology Center.

Ff and Re soils are typically juxtaposed to form a drainage sequence (Soil Survey of Wood County 1977) with the more drained Ff occurring above the Re series. The Re Soils can be observed in the Northern third of the N.A. and County Park, where water often pools in the spring and wet summers.

Late in the 19th century, Powers Bluff was thoroughly logged to the extent that it was locally known as “Bald Mountain” (Engel 1985). The Wood County Park Commission holds the land parcels presently known as Powers Bluff County Park and the Research Natural Area. (Read 1977). The County Park Commission and the Wisconsin Department of Natural Resources jointly manage the Research Natural Area. Current park management is multi-use recreation that includes cross-county skiing, hiking, sledding, wildlife observation, cultural education, and picnicking (Perkins, 1998). The position of the natural area within the park is shown in Fig. 3; it is also shown in Meyer (2003).

METHODS

Sampling Design

Vegetation was sampled in thirty-one 20m-diameter circular plots systematically located from a random starting point within the 28 ha natural area. Plots were spaced at 67m apart along north-south transects. Circular subplots of 10m (diameter) and 1m² were nested within each 20m diameter plot (Figure 4). Understory vegetation was inventoried in eight 1m² quadrats located within each plot (Figure 4). All 20m diameter plots were permanently marked with red-painted aluminum stakes and their positions recorded in latitude and longitude with a Trimble GPS unit.



FIGURE 3. Aerial photograph (1938) of Powers Bluff County Park and State Natural Area. The white lines are estimates of the present-day boundaries. The unit on the left is the county park and the unit on the right is the Natural Area. Both units continue south beyond the limits of this photo. Note lighter area in the northern section of the Park and Natural Area, where logging took place.

Measurements

Species and diameter at breast height (DBH) were recorded for each overstory tree (greater than 15.3cm DBH) in each 20m diameter plot. Species and number of understory trees (5.1cm to 15.2cm DBH and greater than 1m tall) and shrubs (greater than 1m high and less than 5cm DBH) were recorded within the 10m diameter subplot. Percent coverage of the following were estimated in each 1m² plot; each herbaceous plant species, bare soil, rock, coarse litter (woody debris > 2.5cm diameter) and fine litter (woody and non-woody debris). Percent cover was estimated by 1% intervals up to 5% then by 5% intervals up to 100%. The herbaceous layer was sampled in May and in August. Nomenclature follows Gleason & Cronquist (1991).

Analytical Methods

Vegetation data were summarized by density, frequency, basal area, percent cover, and importance values (from Barbour et al., 1987). For the overstory tree layer, importance value was calculated as the sum of relative basal area, relative frequency, and relative density. For the understory tree and shrub layers, importance values were calculated as the sum of relative frequency and relative density. For herb layer species, importance values for each sampling period were calculated as the

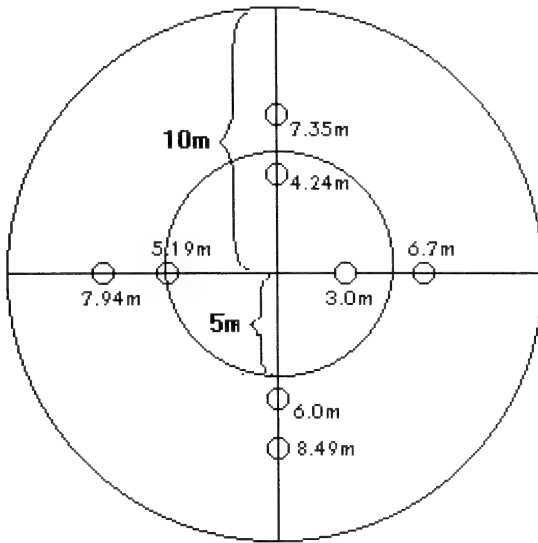


FIGURE 4. Nested plot design for Powers Bluff Maple Woods State Research Natural Area (No. 131) base line data acquisition project.

sum of the relative frequency and relative cover. Importance values reported in tables have been relativized (importance values divided by 200 or 300).

The Shannon-Wiener index of evenness and diversity (H') (Shannon & Weaver 1949) and the complement of Simpson's (1949) original index of diversity were calculated at the plot level for both the spring and fall sampling periods using PC-ORD (McCune & Mefford 1999). Two-tailed t-tests were used to compare these measures between sampling periods. The Sorenson coefficient of similarity was calculated to evaluate the similarity between the spring and late summer floras (Sorensen, 1948).

RESULTS

Forest Structure

Live and dead overstory tree densities in the Natural Area were 347 and 16 stems per hectare respectively (Table 1). The density and composition of overstory trees were similar to those of the understory trees. This structure suggests the recruitment of shade-tolerant species, especially sugar maple, into the understory (Table 2). The diameter distributions of the overstory trees (stems > 15.3 cm dbh) (Figure 5) approximates the reverse-J shape curve of an all-age forest (Lorimer and Krug 1983).

Understory herbaceous plant cover at the Natural Area averaged 57% in the spring and 40% in the fall per 1m² (Table 1). Fine litter cover averaged 92%, indicating an almost continuous litter layer. Exposed rock, soil patches and coarse litter cover account for 2.6, 1.5, and 6% of the forest ground layer (Table 1).

TABLE 1. Forest structure of Natural Area including live and standing dead densities of overstory trees (>15.3 cm DBH), understory trees (5.1 cm < x < 15.2 cm DBH), and shrubs (> 1 meter high, < 5.1 cm DBH). Also included is average cover per meter squared of spring and late summer herbaceous layer, fine (twigs < 1" in diameter and downed leaves) and coarse (woody debris > 2" in diameter) litter, exposed soil, and rock.

Layer	Alive Stem Density/ha	Dead Stem Density/ha
Overstory trees	347	16
Understory trees	419	68
Shrubs	2473	267

	Average Cover (%)	Standard Error	Maximum Cover (%)	Minimum Cover (%)
Herbaceous Spring	57.36	1.79	164.00	0.00
Herbaceous Late Summer	39.73	1.42	130.00	0.00
Fine Litter	92.26	0.89	98.00	1.00
Coarse Litter	5.98	0.66	98.00	0.00
Exposed Soil Patches	1.45	0.43	83.00	0.00
Exposed Rock	2.64	0.61	93.00	0.00

TABLE 2. Understory trees (5.1 cm < x < 15.2 cm DBH) of Powers Bluff State Research Natural Area. Species are listed in order of relative importance value (n = 31).

Species	Relative Importance Value (%)	Frequency (%)	Relative Frequency (%)	Relative Density (%)	Average Stems per Hectare
<i>Acer saccharum</i>	49.88	70.97	45.83	53.92	226
<i>Ostrya virginiana</i>	16.12	22.58	14.58	17.65	74
<i>Carya cordiformis</i>	14.71	25.81	16.67	12.75	53
<i>Fraxinus americana</i>	11.21	22.58	14.58	7.84	33
<i>Tilia americana</i>	8.09	12.90	8.33	7.84	33

Overstory

Twelve overstory species were recorded. The five most important overstory trees were *Fraxinus americana*, *Acer saccharum*, *Quercus rubra*, *Carya cordiformis* and *Tilia americana* (Table 3). These species each had relative importance values much higher (>15%) than the remaining species (Table 3). The frequency data show that the majority of species are relatively even in their distribution across the site. However, two species, *Betula allegheniensis* and *Acer rubrum* L. were found exclusively on the lower, poorly-drained north side of the property.

Understory

Five species were recorded in the understory tree stratum (Table 2). Sugar maple was the most prevalent of these species, accounting for 54% of the stems, and occurring in 71% of the plots. Fifteen species were recorded in the shrub class (Table 4). *Acer saccharum* was again the most abundant species, accounting for 61% of the stems, and appearing in 97% of the plots. *Quercus rubra*, the

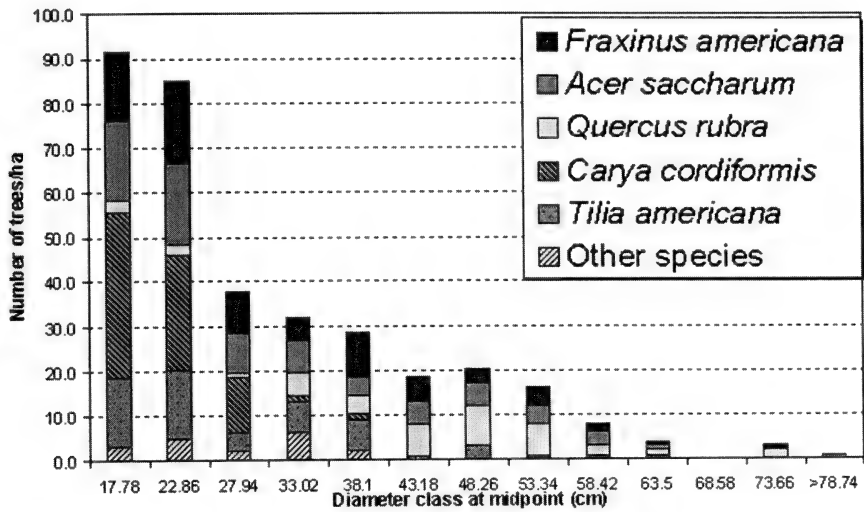


FIGURE 5. Diameter distribution for overstory trees (> 15.24 cm dbh) and for the five most important species at Powers Bluff State Research Natural Area.

third most important overstory tree species, was noticeably absent from the understory tree stratum, and low in importance in the shrub layer, indicating a lack of recruitment of this species.

Herbaceous Layer

Thirty herbaceous species had a relative importance value greater than 1% in the May sampling period (Table 5). This represented approximately 29% of the 105 herbaceous layer species encountered during May sampling. These 105

TABLE 3. Overstory trees (> 15.3 cm DBH) of Powers Bluff State Research Natural Area. Species are listed in order of relative importance value (n = 31).

Species	Relative Importance Value (%)	Relative Basal Area (%)	Frequency (%)	Relative Frequency (%)	Relative Density (%)	Average Stems per hectare
<i>Fraxinus americana</i>	22.07	23.25	80.65	21.37	21.60	75
<i>Acer saccharum</i>	21.49	22.37	77.42	20.51	21.60	75
<i>Quercus rubra</i>	17.88	26.09	54.84	14.53	13.02	45
<i>Carya cordiformis</i>	16.12	9.93	61.29	16.24	22.19	77
<i>Tilia americana</i>	15.36	13.87	61.29	16.24	15.98	55
<i>Juglans cinerea</i>	2.08	1.33	12.90	3.42	1.48	5
<i>Populus tremuloides</i>	1.69	1.59	6.45	1.71	1.78	6
<i>Populus grandidentata</i>	0.97	0.60	6.45	1.71	0.59	2
<i>Betula alleghaniensis</i>	0.89	0.36	6.45	1.71	0.59	2
<i>Acer rubrum</i>	0.63	0.44	3.23	0.85	0.59	2
<i>Ostrya virginiana</i>	0.41	0.09	3.23	0.85	0.30	1
<i>Ulmus americana</i>	0.41	0.09	3.23	0.85	0.30	1

TABLE 4. Shrub layer vegetation (> 1 meter high, < 5.1 cm DBH) of Powers Bluff State Research Natural Area. Species are listed in order of relative importance value (n = 31).

Species	Relative Importance Value (%)	Frequency (%)	Relative Frequency (%)	Relative Density (%)	Average Stems per hectare
<i>Acer saccharum</i>	48.17	96.77	34.88	61.46	1520
<i>Fraxinus americana</i>	9.22	25.81	9.30	9.14	226
<i>Ostrya virginiana</i>	9.22	29.03	10.47	7.97	197
<i>Tilia americana</i>	6.81	25.81	9.30	4.32	107
<i>Carya cordiformis</i>	5.32	22.58	8.14	2.49	62
<i>Sambucus pubens</i>	4.32	19.35	6.98	1.66	41
<i>Hamamelis virginiana</i>	3.41	6.45	2.33	4.49	111
<i>Corylus cornuta</i>	2.82	9.68	3.49	2.16	53
<i>Prunus virginiana</i>	2.82	12.90	4.65	1.00	25
<i>Quercus rubra</i>	2.33	9.68	3.49	1.16	29
<i>Staphylea trifolia</i>	1.99	6.45	2.33	1.66	41
<i>Corylus americana</i>	1.33	3.23	1.16	1.50	37
<i>Viburnum acerifolium</i>	0.91	3.23	1.16	0.66	16
<i>Acer rubrum</i>	0.66	3.23	1.16	0.17	4
<i>Ribes sp.</i>	0.66	3.23	1.16	0.17	4

species account for 77% of the 136 total species recorded during both sampling periods. *Hydrophyllum virginianum* L. (Virginia waterleaf) was the most important species. (Table 5).

Table 6 shows the thirty-three herbaceous species that occurred in the August sample with a relative importance value of 1.00 or higher. These species account for 27% of the 121 species encountered during the August sampling period. These 121 species account for 89% of the 136 species recorded during both sampling periods. Wood nettle (*Laportea canadensis* (L.) Wedd.) was the most important species in this sampling period.

DISCUSSION

The importance of the Spring herbaceous layer

The spring ephemerals accounted for approximately 6% (6/105) of the May herbaceous flora. Several spring ephemerals, such as *Erythronium americanum* Ker-Gawler, *Claytonia virginica*, *Allium tricoccum*, and *Dicentra cucullaria* are included among the most important species (based on importance values) in the spring sample (Table 5). Other spring-blooming plants were also of high importance during the May sampling period. These include *Hydrophyllum virginianum*, *Trillium grandiflorum* and *Podophyllum peltatum* L. (Table 5). The richness in this community in May is much higher than heretofore reported in similar forest stands. For example, Metzger & Schultz (1981) reported only 30 taxa in the spring ground layer under a northern hardwood forest in Michigan. In another study of the spring herb community, Rogers (1981) documented only 47 total species in a relevé sample of 46 stands.

Nearly one-third (9/30) of the most important species for the spring sample

TABLE 5. Thirty most important spring herbaceous plants Powers Bluff State Research Natural Area. Species are listed in order of relative importance. *Standard error is the standard error of the average percent cover per plot (n=31). ^M Species are modal to the southern mesic forest community in Wisconsin.

Species	Relative Importance Value (%)	Frequency (%)	Relative Frequency (%)	Relative Cover (%)	Average Cover per Plot (%)	Standard Error*	Minimum Cover (%)	Maximum Cover (%)
<i>Hydrophyllum virginianum</i> ^M	6.64	100.00	3.16	10.12	45.48	7.46	4.00	184.00
<i>Trillium grandiflorum</i> ^M	5.71	100.00	3.16	8.27	37.16	5.24	2.00	133.00
<i>Podophyllum peltatum</i> ^M	4.58	77.42	2.44	6.72	30.19	7.50	0.00	148.00
<i>Caulophyllum thalictroides</i>	4.41	70.97	2.24	6.57	29.52	6.29	0.00	121.00
<i>Smilacina racemosa</i>	3.96	74.19	2.34	5.58	25.07	7.66	0.00	193.00
<i>Acer saccharum</i>	3.69	96.77	3.05	4.32	19.39	4.41	0.00	110.00
<i>Dicentra cucullaria</i>	3.28	80.65	2.55	4.02	18.07	7.90	0.00	246.00
<i>Allium tricoccum</i> ^M	3.25	64.52	2.04	4.47	20.07	6.61	0.00	162.00
<i>Osmorhiza claytonii</i>	3.22	96.77	3.05	3.39	15.23	2.21	0.00	45.00
<i>Hepatica acutiloba</i> ^M	2.94	77.42	2.44	3.44	15.45	3.35	0.00	80.00
<i>Erythronium americanum</i>	2.90	74.19	2.34	3.45	15.52	3.17	0.00	78.00
<i>Uvularia grandiflora</i>	2.62	64.52	2.04	3.21	14.42	4.94	0.00	136.00
<i>Laportea canadensis</i>	2.52	51.61	1.63	3.42	15.36	5.17	0.00	105.00
<i>Claytonia virginica</i> ^M	2.45	96.77	3.05	1.85	8.32	1.17	0.00	33.00
<i>Polygonatum pubescens</i>	2.26	96.77	3.05	1.47	6.61	0.70	0.00	18.00
<i>Anemone quinquefolia</i>	2.24	87.10	2.75	1.74	7.81	2.65	0.00	71.00
<i>Thalictrum dioicum</i>	2.11	74.19	2.34	1.87	8.42	1.86	0.00	46.00
<i>Impatiens pallida</i>	1.86	83.87	2.65	1.06	4.77	0.96	0.00	26.00
<i>Viola pubescens</i> ^M	1.84	74.19	2.34	1.34	6.00	1.29	0.00	22.00
<i>Geranium maculatum</i>	1.74	45.16	1.43	2.05	9.19	4.26	0.00	105.00
<i>Carya cordiformis</i>	1.67	87.10	2.75	0.60	2.68	0.35	0.00	7.00
<i>Solidago flexicaulis</i> ^M	1.60	61.29	1.93	1.26	5.68	1.59	0.00	37.00
<i>Maianthemum canadense</i>	1.43	58.06	1.83	1.03	4.65	1.58	0.00	30.00
<i>Osmorhiza longistylis</i>	1.39	54.84	1.73	1.06	4.74	2.08	0.00	59.00
<i>Sanguinaria canadensis</i>	1.39	67.74	2.14	0.63	2.84	0.72	0.00	16.00
<i>Sanicula gregaria</i>	1.27	58.06	1.83	0.71	3.19	1.06	0.00	25.00
<i>Galium triflorum</i>	1.20	45.16	1.43	0.97	4.36	1.48	0.00	34.00
<i>Fraxinus americana</i>	1.15	58.06	1.83	0.47	2.13	0.51	0.00	10.00
<i>Streptopus roseus</i>	1.09	51.61	1.63	0.55	2.48	0.95	0.00	21.00
<i>Actea rubra</i>	1.04	45.16	1.43	0.65	2.94	0.89	0.00	16.00

TABLE 6. Thirty-three most important late summer herbaceous plants in the Natural Area. Species are listed in order of relative importance. Standard error is the standard error of the average percent cover per plot ($n = 31$). ^M Species are modal to the southern mesic forest community in Wisconsin.

Species	Relative Importance Value (%)	Frequency (%)	Relative Frequency (%)	Relative Cover (%)	Average Cover per Plot (%)	Standard Error*	Minimum Cover (%)	Maximum Cover (%)
<i>Laportea canadensis</i>	13.09	54.84	1.75	24.43	77.10	23.72	0.00	546.00
<i>Acer saccharum</i>	4.54	90.32	2.89	6.18	19.52	3.69	0.00	75.00
<i>Amphicarpaea bracteata</i>	4.00	58.06	1.86	6.14	19.39	7.23	0.00	196.00
<i>Uvularia grandiflora</i>	3.67	74.19	2.37	4.98	15.71	3.94	0.00	95.00
<i>Hepatica acutiloba</i> ^M	3.50	77.42	2.47	4.53	14.29	2.47	0.00	53.00
<i>Smilacina racemosa</i>	3.25	90.32	2.89	3.61	11.39	2.44	0.00	46.00
<i>Osmorhiza claytonii</i>	3.22	100.00	3.20	3.24	10.23	1.05	1.00	26.00
<i>Hydrophyllum virginianum</i> ^M	3.21	96.77	3.09	3.33	10.52	1.82	0.00	41.00
<i>Fraxinus americana</i>	2.97	93.55	2.99	2.95	9.32	1.64	0.00	35.00
<i>Caulophyllum thalictroides</i> ^M	2.94	70.97	2.27	3.62	11.42	2.73	0.00	63.00
<i>Carya cordiformis</i>	2.68	90.32	2.89	2.47	7.81	1.59	0.00	41.00
<i>Thalictrum dioicum</i>	1.96	74.19	2.37	1.54	4.87	0.88	0.00	19.00
<i>Trillium grandiflorum</i> ^M	1.94	80.65	2.58	1.30	4.10	1.03	0.00	27.00
<i>Solidago flexicaulis</i> ^M	1.77	61.29	1.96	1.57	4.97	1.25	0.00	31.00
<i>Sanicula gregaria</i>	1.57	54.84	1.75	1.38	4.36	1.05	0.00	17.00
<i>Osmorhiza longistylis</i>	1.56	74.19	2.37	0.75	2.36	0.42	0.00	7.00
<i>Cryptotaenia canadensis</i>	1.50	64.52	2.06	0.93	2.94	0.70	0.00	16.00
<i>Polygonatum pubescens</i> ^M	1.48	70.97	2.27	0.70	2.19	0.38	0.00	7.00
<i>Sanicula trifoliata</i>	1.48	64.52	2.06	0.90	2.84	0.65	0.00	13.00
<i>Sanguinaria canadensis</i> ^M	1.47	67.74	2.16	0.78	2.45	0.50	0.00	10.00
<i>Circaea luteana</i>	1.31	64.52	2.06	0.56	1.77	0.33	0.00	6.00
<i>Phryma leptostachya</i>	1.30	64.52	2.06	0.54	1.71	0.36	0.00	7.00
<i>Viola sororia</i>	1.30	64.52	2.06	0.54	1.71	0.46	0.00	12.00
<i>Viola pubescens</i> ^M	1.27	54.84	1.75	0.80	2.52	0.76	0.00	18.00
<i>Mitella diphylla</i>	1.24	58.06	1.86	0.62	1.97	0.50	0.00	13.00
<i>Galium asprellum</i>	1.22	41.94	1.34	1.09	3.45	1.20	0.00	25.00
<i>Adiantum pedatum</i>	1.14	32.26	1.03	1.25	3.94	1.25	0.00	24.00
<i>Athyrium filix-femina</i>	1.12	25.81	0.82	1.41	4.45	2.09	0.00	52.00
<i>Allium tricoccum</i> ^M	1.11	54.84	1.75	0.46	1.45	0.34	0.00	6.00
<i>Impatiens pallida</i>	1.04	48.39	1.55	0.54	1.71	0.49	0.00	11.00
<i>Geranium maculatum</i>	1.04	38.71	1.24	0.84	2.65	0.79	0.00	16.00
<i>Parthenocissus vitacea</i>	1.02	45.16	1.44	0.59	1.87	0.57	0.00	13.00
<i>Carex pensylvanica</i>	1.01	19.35	0.62	1.40	4.42	3.31	0.00	100.00

period are modal (*sensu* Curtis 1959) in the southern mesic forest community of Wisconsin, meaning that each occurs more frequently in this community type than in any other broad community type in Wisconsin (presence value, Curtis 1959). The four most important spring species in the Natural Area, *Hydrophyllum virginianum*, *Trillium grandiflorum*, *Caulophyllum thalictroides*, and *Podophyllum peltatum* (Table 5) are all modal to this community type (Curtis 1959). Two of the thirty most important spring species at Powers Bluff, *Erythronium americanum* and *Polygonatum pubescens* (Willd.) Pursh. are modal to the northern mesic forest. Given the location of Powers Bluff (Figure 1) and these northern and southern floristic elements, these findings support Curtis's (1959) ideas about a tension zone in Wisconsin.

Seasonal changes in the herbaceous layer

In comparing the most important herbs of the spring and fall, one might infer that a sharp change took place between the two sampling periods. However, the level of similarity between the spring and late-summer floras was surprisingly high. A similar comparison from southern Ohio in a slightly more xeric ecosystem found an index of similarity between spring and summer time periods of < 0.4 (Goebel et al. 1999). The similarity coefficient in the Natural Area was 0.80, indicating that a strong majority of species occurred at both periods. The index of similarity accounts for the presence of all species, including the species that are not included in the most important listing, most of which persisted from one sampling period to the next. This similarity indicates the dominance of a spring/summer phenological pattern.

Aspects of Diversity

Diversity (H') is a function of richness and evenness. Richness (S), Shannon-Wiener evenness (E), Shannon-Wiener diversity (H') and Simpson (D') diversity were not significantly different between sampling periods ($n = 31$, $p_S = 0.63$, $p_E = 0.20$, $p_{H'} = 0.27$, $p_{D'} = 0.06$). Because richness is equivalent between sampling periods, the high evenness values (0.74, 0.78) indicate that a strong majority of the species are represented by approximately the same amount of cover. High evenness values have historically been associated with late successional ("climax") communities (Odum 1969). High evenness can occur if the species have finely divided the total habitat such that each species can occur in only a few places; that is, each species has a narrow niche. This is most likely to occur if the composition and climate are stable for an extended period. This, however, is not a likely explanation for Powers Bluff given the disturbance history described above. Alternatively, evenness may reach its maximum soon after the resource levels have stabilized, such as that which occurs shortly after canopy closure (Nicholson and Monk 1974). A third alternative is that the current evenness is a function of the pre-disturbance (i.e., before ca. 1900) distribution (e.g., Hughes & Fahey 1991) and the limited dispersal capacity of most forest herbs (Matlack 1994). Both of the latter two alternatives appear to be plausible explanations for the high evenness in the Natural Area.

Many quantitative ecological studies of the understories of mesic deciduous forests have been conducted, often in "old-growth" or "relatively undisturbed

and mature" forests. These studies (e.g., Levenson & Jackson 1980; Metzger & Schultz 1981, 1984; Rogers 1981; Whitney & Foster 1988, Scheiner & Istock 1994, Goebel et al. 1999) provide a reasonable benchmark for this study. One very striking difference between the current study and the past studies is that the understory flora of this community is 1.5–3.5 times richer than all of these other studies. Three complementary explanations may explain this difference: (1) the location of the Natural Area—at an ecotone between two major forest biomes, the boreal forests and the eastern deciduous forests; (2) the range of site conditions (see Historical Forces section) within the Natural Area; (3) a careful and complete identification of plants located within the quadrats. Scheiner & Istock (1994) found enriched forests in Michigan at this same ecotone. The blend of northern and southern species within one community suggests that this area has an unusual value for the state of Wisconsin.

Exotic Species

The non-native species found in our sample, *Taraxacum officinale*, *Prunella vulgaris*, and *Oxalis stricta* (native to WI but probably not native to the bluff, R.W. Freckmann *personal communication.*), contributed only 2.2% (3/136) of the flora (Table 7). This is much lower than most communities from this region.

TABLE 7. List of introduced species found at Powers Bluff County Park and Natural Area based on R.W. Freckmann (unpubl. data). Status of introduced plants follows Wetter et al. (1998) and introduced plants at Powers Bluff is according to R.W. Freckmann (*personal communication*)

Species	Status
<i>Picea glauca</i>	Native to WI, but introduced at Powers Bluff
<i>Picea abies</i>	Introduced—persisting and spreading
<i>Ambrosia artemisiifolia</i>	Native to WI, but introduced at Powers Bluff
<i>Arctium minus</i>	Introduced—naturalized; ecologically invasive
<i>Campanula rapunculoides</i>	Introduced—naturalized; ecologically invasive
<i>Chenopodium simplex</i>	Native to WI, but introduced at Powers Bluff
<i>Chrysanthemum leucanthemum</i>	Introduced—naturalized; ecologically invasive
<i>Cirsium vulgare</i>	Introduced—naturalized; ecologically invasive
<i>Erigeron strigosus</i>	Native to WI, but introduced at Powers Bluff
<i>Hieracium aurantiacum</i>	Introduced—naturalized; ecologically invasive
<i>Oxalis stricta</i>	Native to WI, but introduced at Powers Bluff
<i>Polygonum cilinode</i>	Native to WI, but introduced at Powers Bluff
<i>Polygonum pensylvanicum</i>	Native to WI, but introduced at Powers Bluff
<i>Polygonum persicaria</i>	Introduced—naturalized
<i>Prunella vulgaris</i>	Introduced—naturalized
<i>Ranunculus acris</i>	Introduced—naturalized
<i>Ptelea trifoliata</i>	Native to Southern WI, but introduced at Powers Bluff
<i>Solanum ptycanthum</i>	Native to WI, but introduced at Powers Bluff
<i>Tanacetum vulgare</i>	Introduced—naturalized
<i>Taraxacum officinale</i>	Introduced—naturalized
<i>Urtica dioica</i>	Introduced—naturalized
<i>Dactylis glomerata</i>	Introduced naturalized; potentially invasive
<i>Echinochloa muricata</i>	Native to WI, but introduced at Powers Bluff
<i>Panicum capillare</i>	Native to WI, but introduced at Powers Bluff
<i>Phalaris arundinacea</i>	Introduced—naturalized; ecologically invasive
<i>Phleum pratense</i>	Introduced—naturalized; potentially invasive
<i>Setaria pumila</i>	Introduced—naturalized

The percentages of non-native species averaged 27% in a study of 22 National Parks throughout the Midwest (Bennett 1996). A complete plant list for the county park (the Natural Area and the adjacent 90 acres used for recreation) includes 29 non-native species (Table 7) out of a total of 203 (R.W. Freckmann & Kirschbaum, unpublished data). Of these 29 species, 8 are considered "ecologically or potentially invasive" (Wetter et al. 1998), but to date have not been found in the interior of the Natural Area. These data and patterns suggest that the Powers Bluff Natural Area has shown unusual resistance to invasion by non-native species. Three factors may account for this:

- 1) High species richness has been suggested since at least the 1950s as an important factor in resistance to invasion (Elton 1958). The mechanism for such a resistance phenomenon could be the lack of unfilled niches and/or the extremely efficient use of resources by the current plant occupants. Either could prevent "new" species from becoming established.
- 2) Lack of large-scale anthropogenic disturbance. Disturbance creates an opportunity for colonization by producing unoccupied space and by freeing up resources, and thus may be a key to the establishment of exotics (Hobbs and Hunneke, 1992). The last major disturbance at Powers Bluff was 80–100 years ago.
- 3) Topographic isolation—The Bluff is surrounded by level terrain, the vast majority of which has been in agriculture since at least the 1930s. Brothers & Spingarn (1992) explain the low levels of alien species in remnants of old growth forest in Indiana, by suggesting that invasion by non-native species is limited by dispersal. Crop weeds move only short distances without human aid, and invasive species from urban or pasture settings are limited by the long distances between the source site and these forest patches. Powers Bluff may have avoided non-native invasion because the source populations are limited.

CONCLUSION

Powers Bluff County Park and Natural Area is a vegetatively and geologically unusual area in Central Wisconsin. Erosion-resistant parent material and wind-deposited loess merged to provide a diverse topography but relatively mesic soil conditions. Both the Native Americans and the Europeans have impacted the plant community of the bluff through use of the native plants, logging, and the introduction of species. The forest at Powers Bluff is an all-aged Southern mesic forest, but contains elements of the Northern mesic forest. We found that the herbaceous vegetation is exceptionally rich and dominated by species with a spring/summer phenological pattern. A major component of this late summer flora was wood-nettle, a species which is modal to wet forests. Its local abundance is due to vigorous clonal spread and competitive abilities under mesic site conditions.

The plant community of Powers Bluff remains intact, with very few invasive

species in the interior of the forest. Those that are present are confined to disturbed areas along roads, and at the north end of the Natural Area, an area disturbed in the late 1930s. We have proposed three mechanisms that may have allowed Powers Bluff to be resistant to invasive species; high species richness, low levels of disturbance, and isolation from source populations.

Finally, this study provides baseline vegetation data and permanent plots for future study of the area. These data will provide an important benchmark as the forest matures and overstory species die, and as a reference point for the adjacent managed county park.

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BOOK REVIEW

Janes L. Forsyth. 2003. Linking Ohio Geology and Botany: Papers by Jane L. Forsyth. Compiled by Ronald L. Stuckey, RLS Creations, P.O. Box 12455, Columbus, Ohio 43212; \$47 postpaid, hardbound. ISBN 0-9668034-7-7; xiv + 365 pages.

One can do no better to summarize this book than to quote from the Foreword to this remarkable tribute to Jane L. Forsyth: "Through her teachings and interpretive writings, the geology of Ohio has been made understandable to a wide spectrum of individuals ranging from professional glaciologists to folks with a casual interest in their natural surroundings. Unfortunately, Dr. Forsyth's many published research findings and essays are scattered throughout the scientific and popular literature and thus are not easily accessed in a comprehensive way."

This is not an exhaustive compendium, but it is a very considerable fraction of her work. As usual in any work by Ron Stuckey, every one of the papers is precisely and exactly identified as to its source, and the reproduction of every item is photographic, with the pagination of the original preserved—the pagination of this book itself runs below the papers. Papers of general interest include such items as "The geological setting of the Great Lakes," which originally appeared in a book, *The Great Lake Erie*, in 1987. This title is itself apparently rare or scarce—certainly, the reproduction of this one paper is a service to the community.

The book is richly illustrated, including some full-color maps. The linkage between Ohio geology and botany is slim, but that's of little moment. In its pages, there lies a liberal education, easily understandable by all.

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THE BIG TREES AND SHRUBS OF MICHIGAN

40. *Asimina triloba* (L.) Dunal

Pawpaw

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The largest known Pawpaw tree in Michigan is located in the city of Paw Paw in Van Buren County in the southwest part of the Lower Peninsula. (The common name is usually spelled as one word, or sometimes hyphenated as Paw-paw. The name of the city, by contrast, is officially two words, even though it is named for the tree.)

Description of the species: The Pawpaw belongs to the Annonaceae or Custard Apple family of the order Magnoliales. This is mostly a sub-tropical and tropical family. The only representative in Michigan is the Pawpaw. This tree can be recognized by its large, simple, alternate leaves with prominent veins and short thick petioles (see Fig. 1). The large (3–4 cm across) dark reddish-purple flowers appear in mid-spring and have 3 sepals, 6 petals, numerous stamens and 3–5 ovaries. The large edible fruit ripens in the fall. It is yellow-green at first, turning to brown or black later. The fruit is a large berry which may grow to be 5–12 cm long and 2–6 cm thick. The tree is infrequent in southern Michigan where it reaches the northern limits of its range. The fruits may be eaten raw and may be made into a variety of desserts. Some people find it to be quite sweet. Others find the taste to be rather revolting.

Location of Michigan's Big Tree: Michigan's largest Pawpaw tree is located in front of the Paw Paw Community Education Building at 600 E. Michigan Ave. in Paw Paw, MI. There are three trees in a cluster with the largest leaning slightly toward the road. The tree can be reached by taking exit 60 from Interstate 94 and going 0.7 miles north to Michigan Ave. at the center of Paw Paw. Turn right and go 0.4 mi. to 600 E. Michigan Avenue, the location of the Paw Paw Community Education Building, formerly the Paw Paw middle school. The GPS coordinates for this location are N42°13.077' and W85°52.970'.

Description of Michigan's Big Tree: The tree has a single, solid, healthy trunk. Its girth at 4½' above the ground was measured on 12 July 2003 as 39" (1 m). The tree was 37' (11 m) high and had a crown spread of 34' (10 m). The total points for this tree are $39 + 37 + \frac{1}{4} \times 34 = 85$.

INVITATION TO PARTICIPATE

If you would like to join in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B. Ehrle at

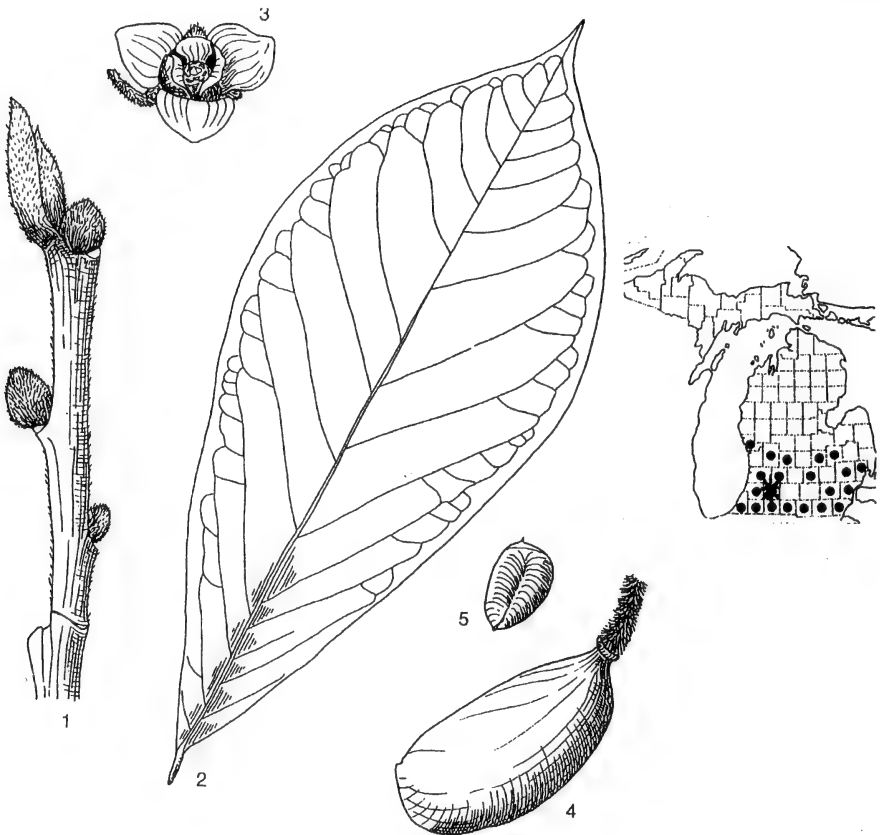


FIGURE 1. Characteristics of the Pawpaw and location of Michigan's Big Tree. The map is from Voss (1985). The asterisk on the map indicates the location of Michigan's Big Tree. The drawings are from Barnes & Wagner (1981). 1. Winter twig, $\times 2\frac{1}{2}$. 2. Leaf, $\times \frac{1}{2}$. 3. Flower $\times \frac{1}{2}$. 4. Fruit, berry, $\times \frac{1}{2}$. 5. Seed, $\times \frac{1}{2}$.

woodyehrle@aol.com for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property. For the most recent list of Michigan's Big Trees see Ehrle (2003).

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VASCULAR PLANTS OF "KAUKAMO SPRUCES," A 20-ACRE TRACT IN THE LAKE SUPERIOR LOWLANDS OF BAYFIELD COUNTY, WISCONSIN

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In the "Flora of Butternut Pines" (Judziewicz 2004) I pointed out that "microfloras" are a useful way of sampling floristic and vegetational diversity on a regional scale. A grid of, say, 100 "microflora plots" positioned statewide (and not just clustered around the well-known "usual suspects": universities and university field stations), thoroughly re-surveyed every ten or twenty years, would go a long way towards this goal.

Presented here are the results of a floristic survey of a remote eight hectare (20-acre) tract bordering the Iron River in extreme northwestern Bayfield County in the Lake Superior lowlands of far northwestern Wisconsin, about midway between the cities of Superior and Ashland. Purchased by Wyat D. Judziewicz and his wife Elaine Ruzycki in January 1993 as a residence, "Kaukamo Spruces" is a narrow strip of land 330 feet wide and 2640 feet long extending (much like a gigantic transect) from plateau-top abandoned farmland down (eastward) to the steep-sided, densely-wooded valley of the Iron River (Fig. 1). The location is as follows: Lat. 46°41'N, Long. 91°28'W, Town of Orienta, T49N, R9W, Section 34, on Kaukamo Road about 13 km by air north-northwest of the village of Iron River. The elevation ranges from 765–855 feet above sea level, or 165–255 feet above Lake Superior, which is 8 km to the north-northwest.

METHODS

In 1993 I made 410 collections at Kaukamo Spruces. All are deposited at WIS (the Department of Botany Herbarium, University of Wisconsin-Madison) except for a few deposited at a small herbarium in a Wisconsin Department of Natural Resources ranger station in Brule. The 1993 collections were made on the following dates: 22 May (10105-10164); 19 June (10206-10328); 10 July (10329-10404); 31 July (10406-10487); 22 August (10488-10529); and 4 September (10530-10541). A few more collections were made from 1994-2001. An asterisk (*) denotes species considered alien (introduced) to this part of Bayfield County.

GEOLOGY, GEOGRAPHY, AND SOILS

The western three-quarters of the tract consists of a nearly flat, slightly hummocky, rather poorly-drained plateau of glacial lake till (Miller Creek formation)



FIGURE 1. Steep, east-facing slope above Iron River, 6 August 2001, with large white pines (*Pinus strobus*) and an understory of balsam fir (*Abies balsamea*).

deposited during the high stages of Lake Superior, during and immediately following the last stages of Wisconsin glaciation (Clayton, 1984). The East Fork of Resch Creek bisects the tract; it is a tiny intermittent stream that flows north into the Iron River. The steep sides of the Iron River were cut post-glacially, with attendant slope wash and mass-movement of the very clayey soil. The rather turbid Iron River has wide seasonal variations in flow rate; the bottomland has thick deposits of post-glacial stream sediment and, on the west side, a swampy, abandoned river channel that dries up in most summers except for a puddle or slough near the southeast border. The glacial till is underlain by pre-Cambrian Orienta formation sandstone which outcrops along the Iron River several miles north of the tract, particularly at Orienta Falls. The tract has three soils types (U.S. Department of Agriculture, 1961): alluvial soils in the Iron River floodplain; "steep land of Ontonagon materials" along the slopes overlooking the river; and on the plateau-top, "fine-textured soils of the lake plain," of the Ontonagon-Pickford association. The latter type is common along the Lake Superior plains and consists of red clays and pink sands.

CLIMATE

The tract has a rigorous climate, with cool summers and long, cold, snowy winters. Occasionally, during violent fall storms, the waves of Lake Superior can actually be heard from the tract, five miles inland. However the climate is ameliorated somewhat by the lake's proximity: it is warmer in the winter, cooler in the summer, snowier, and with a longer growing season than higher areas farther inland.

VEGETATION

Finley (1976) maps the tract as on the boundary between boreal forest (dominated by white spruce, balsam-fir, and paper birch) and white and red pine forests. Logging probably removed all forest cover early in this century, and farming followed (Wisconsin Department of Agriculture and Markets, 1929). Following the abandonment of farms during the Depression in the 1930s, young forests dominated by paper birch and quaking aspen have reclaimed about one-half of the tract. The following discussion of the present vegetation proceeds from west to east, from the lake plain plateau down to the Iron River.

1) *West end swampy woods.* The westernmost four acres of the tract are a level, poorly-drained woods dominated by pole-sized quaking aspen (*Populus tremuloides*) and with considerable tag alder (*Alnus incana* subsp. *rugosa*) and winterberry holly (*Ilex verticillata*) in the understory. Mixed with the aspen are scattered small trees of black and green ash (*Fraxinus nigra* and *F. pennsylvanica*), red maple (*Acer rubrum* var. *rubrum*), balsam-fir (*Abies balsamea*), white birch (*Betula papyrifera*), and one or two large white pines (*Pinus strobus*). A

few herbs are restricted to this stand, including *Carex disperma* (a sedge), golden ragwort (*Packera aurea*), purple-stemmed aster (*Aster puniceus*), tearthumb (*Polygonum sagittatum*), crested wood fern (*Dryopteris cristata*), and dwarf raspberry (*Rubus pubescens*).

2) *Old fields.* Between the swampy aspen stand and Kaukamo Road are about ten acres of old fields. The fields are dissected by the East Fork of Resch Creek and by several ditchlike swales (probably dug for drainage), these serving as corridors for the invasion of many trees and shrubs such as quaking aspen, white birch, willows (*Salix bebbiana* and *S. petiolaris*), junberry (*Amelanchier spicata*), and hawthorn (*Crataegus chrysocarpa*). The commonest herbs in the fields themselves (excluding the wet swales) are: redtop (*Agrostis gigantea*), the sedges *Carex castanea*, *C. gracillima* and *C. tenera* var. *tenera*, ox-eye daisy (*Leucanthemum vulgare*), wild strawberry (*Fragaria virginiana*), hawkweeds (*Hieracium aurantiacum*, *H. kalmii*, and *H. piloselloides*), Kentucky bluegrass (*Poa pratensis*), common cinquefoil (*Potentilla simplex*), common buttercup (*Ranunculus acris*), Canada goldenrod (*Solidago canadensis*), and barren-strawberry (*Waldsteinia fragarioides*). The driest, most well-drained parts of the fields occur near the south fenceline and have populations of such species as pearly everlasting (*Anaphalis margaritacea*), poverty oatgrass (*Danthonia spicata*), ticklegrass (*Agrostis hyemalis* var. *scabra*), gray goldenrod (*Solidago nemoralis*), and gray dogwood (*Cornus racemosa*). Springy swales in the old fields boast a sedge meadow component including marsh-marigold (*Caltha palustris*), the sedges *Carex crinita*, *C. pellita*, and *C. stipata*, spotted cowbane (*Cicuta maculata*), swamp thistle (*Cirsium muticum*), joe-pye-weed (*Eupatorium maculatum*), water avens (*Geum rivale*), purple-fringed orchid (*Platanthera psycodes*), swamp buttercup (*Ranunculus hispidus*), and swamp saxifrage (*Saxifraga pensylvanica*).

4) *Resch Creek bottomlands.* The muddy bottom of this intermittent stream has a semi-aquatic flora that includes water-plantain (*Alisma triviale*), bur-reed (*Sparganium emersum*), cat-tail (*Typha latifolia*), water-parsnip (*Sium suave*), water-starwort (*Callitriche palustris*), ditch-stonecrop (*Penthorum sedoides*), and marsh-speedwell (*Veronica scutellata*). The banks, which are fringed with scattered trees of bur oak (*Quercus macrocarpa* var. *macrocarpa*) and American elm (*Ulmus americana*), have a colorful flora that includes blue flag (*Iris versicolor*), boneset (*Eupatorium perfoliatum* var. *perfoliatum*), skullcap (*Scutellaria lateriflora*), Canada anemone (*Anemone canadensis*), rough bedstraw (*Galium asprellum*), hedge-nettle (*Stachys tenuiflora* var. *tenuiflora*), turtlehead (*Chelone glabra*), and monkeyflower (*Mimulus ringens*); many of these species are found nowhere else on the tract, not even along the Iron River.

5) *Roadside, driveway, and house clearing lawn.* These developed areas have many exotics; the commonest are bird's-foot trefoil (*Lotus corniculatus*), common dandelion (*Taraxacum officinale*), and clovers (*Trifolium spp.*).

6) *Boreal forest.* This forest type, which extends from Kaukamo Road east to the edge of the Iron River floodplain, is dominated by balsam-fir, white birch,

quaking aspen, red maple, and bur oak with scattered large individuals of white spruce (*Picea glauca*) and white pine. Associated trees and shrubs include occasional sugar maples (*Acer saccharum* var. *saccharum*) and hop-hornbeam (*Ostrya virginiana*), beaked hazelnut (*Corylus cornuta*), bush-honeysuckle (*Diervilla lonicera*), and arrow-wood viburnum (*Viburnum rafinesquianum*). The herb and sub-shrub flora is diverse and only a few of the more characteristic species may be mentioned here: wild sarsaparilla (*Aralia nudicaulis*), big-leaved aster (*Aster macrophyllus*), corn-lily (*Clintonia borealis*), bunchberry (*Cornus canadensis*), northern comfrey (*Cynoglossum boreale*), spinulose wood fern (*Dryopteris carthusiana*), Canada mayflower (*Maianthemum canadense*), sweet coltsfoot (*Petasites frigidus* subsp. *palmatius*), and bracken fern (*Pteridium aquilinum* subsp. *latiusculum*).

The base of the slope just above (west of) the Iron River floodplain forest has a well-drained floodplain terrace and is the most species-rich area of the tract (in the checklist it is referred to as the "base of the boreal slope"). In addition to many of the species mentioned above, the following predominantly mesic species are found here, often present only as a few individuals: mountain maple (*Acer spicatum*), maidenhair fern (*Adiantum pedatum*), wild leek (*Allium tricoccum* var. *tricoccum*), spikenard (*Aralia racemosa*), wild ginger (*Asarum canadense*), honewort (*Cryptotaenia canadensis*), dutchman's-breeches (*Dicentra cucullaria*), yellow trout-lily (*Erythronium americanum*), nodding fescue (*Festuca subverticillata*), miterworts (*Mitella diphylla* and *M. nuda*), thimbleberry (*Rubus parviflorus*), bloodroot (*Sanguinaria canadensis*), zigzag golden-rod (*Solidago flexicaulis*), and nodding trillium (*Trillium cernuum*).

7) *Bottomland forest*. The floodplain of the Iron River supports a somewhat disturbed bottomland forest with moderately large trees of black ash, basswood (*Tilia americana*), balsam-poplar (*Populus balsamifera*), and especially box-elder (*Acer negundo* var. *negundo*); long-dead trunks of American elm (*Ulmus americana*) also persist (Fig. 2). Shrubs include nannyberry (*Viburnum lentago*) and pasture gooseberry (*Ribes cynosbati*). The dominant understory herbs are large and coarse: cow parsnip (*Heracleum lanatum*), ostrich fern (*Matteuccia struthiopteris* var. *pennsylvanica*), Virginia wild-rye (*Elymus virginicus*), wood-nettle (*Laportea canadensis*), stinging nettle (*Urtica dioica* subsp. *gracilis*), smooth sweet cicely (*Osmorhiza longistylis*), and green-headed coneflower (*Rudbeckia laciniata*). Where the soil is better-drained several of the mesophytic species listed in the previous section are found, plus enchanter's-nightshade (*Circaea lutetiana* subsp. *canadensis*), marsh blue violet (*Viola cucullata*), starry false Solomon's-seal (*Smilacina stellata*), *Carex sprengelii*, blue cohosh (*Caulophyllum thalictroides*), turk's-cap lily (*Lilium michiganense*), and the vines hairy carrion-flower (*Smilax herbacea* subsp. *lasioneura*) and Virginia creeper (*Parthenocissus vitacea*).

8) *Bottomland slough*. An ancient river channel occurs at the base of the boreal slope; it is generally flooded in the spring, and near the south border sometimes retains a stagnant pool all summer. Species found here include arrowhead (*Sagittaria latifolia* var. *latifolia*), several sedges (*Carex alopecoidea*,



FIGURE 2. Iron River and riverbank meadow, 15 July 2001.



FIGURE 3. East Fork of Resch Creek, a tributary of the Iron River, 15 July 2001, with old fields and forest of white birch (*Betula papyrifera*) and quaking aspen (*Populus tremuloides*) visible beyond.

C. bromoides, *C. retrorsa* and *C. tuckermanii*), fowl manna-grass (*Glyceria striata*), beggar-ticks (*Bidens frondosus*), spotted touch-me-not (*Impatiens capensis*), forget-me-not (*Myosotis scorpioides*), northern bugleweed (*Lycopus uniflorus*), and marsh bedstraw (*Galium tinctorium*).

9) *Riverside thicket*. The Iron River is characterized by widely varying flow levels that preclude both full development of trees along some of its banks, and also the development of an aquatic flora; the only true aquatic in the river part of the tract was a small colony of waterweed (*Elodea canadensis*) (Fig. 3). The riverside has a light thicket of sandbar and shining willows (*Salix exigua* subsp. *interior* and *S. lucida* subsp. *lucida*), the vines wild-cucumber (*Echinocystis lobata*), hops (*Humulus lupulus*), virgin's-bower (*Clematis virginiana*), hedgebindweed (*Calystegia sepium*), and the following herbs (as well as many species found in the west field swale and Resch Creek wetlands): the sedges *Carex hystericina*, *C. stricta* and *C. trichocarpa*, a spikerush (*Eleocharis erythropoda*), a rush (*Juncus nodosus*), rice cut-grass (*Leersia oryzoides*), giant chickweed (*Stellaria aquatica*), blue vervain (*Verbena hastata*), and, unfortunately, large and spreading thickets of reed canary grass (*Phalaris arundinacea*).

DISCUSSION

Kaukamo Spruces has a relatively rich flora for a tract of its size and location. This is probably due to the diverse habitats associated with the Iron River and its rather deeply incised valley, and the fact that the steep valley slopes support remnant coniferous boreal forest. For example, the flora of 352 vascular plant species greatly exceeds that of Oak Island (308 species), even though the latter is 250 times as large (5,029 acres) (Judziewicz & Koch 1993). The tract shares 314 species in common with the Apostle Islands (803 species; Judziewicz & Koch 1993), yielding a similarity index of 55%.

Compared with the 40-acre "Butternut Pines" tract in Oconto County, Wisconsin (Judziewicz 2004; 525 species), Kaukamo Spruces is more depauperate floristically, even allowing for the difference in size. This is probably due to Butternut Pines' combination of greater habitat diversity, better-drained soils, more temperate climate, and more southerly location (in general, biodiversity is inversely correlated with latitude). The two tracts have 280 species in common, thus a similarity index of 64%. Butternut Pines is richer in several families with acidic soil preferences and/or associated mycorrhizal symbionts: The Lycopodiaceae, Ophioglossaceae, Orchidaceae, Pyrolaceae, and Ericaceae total 31 species for Butternut Pines versus only 8 species for Kaukamo Spruces (17 or 18 species could be expected from size alone).

There is one species classified as of "Special Concern" by the Wisconsin DNR on the tract. Vasey's rush (*Juncus vaseyi*) is known from only a few dozen locations in the states of Minnesota, Wisconsin, and Michigan. In far northern Wisconsin, it is now known to be locally common in and around the city of Superior. Buffaloberry (*Shepherdia canadensis* Nutt.), a calciphilic shrub charac-

teristic of the clay plain and clay bluffs of Lake Superior in this part of Wisconsin, is found south (inland) to within 1 km of the tract (*Judzewicz 10746*).

Not surprisingly given its northern location, Kaukamo Spruces marks or nearly marks the northern range limits of a dozen or more vascular plant species in Wisconsin. Most of these are mesophytes growing in rich, protected soil on the lower slopes, infrequently flooding floodplain terrace, or floodplain proper of the Iron River. These species include wild leek (*Allium tricoccum* var. *tricoccum*), hog-peanut (*Amphicarpaea bracteata*), Canada brome (*Bromus pubescens*), several sedges (*Carex bromoides* var. *bromoides* and *C. sprengelii*), turtle-head (*Chelone glabra*), broad-leaved enchanter's-nightshade (*Circaea lutetiana* subsp. *canadensis*), Virginia spring-beauty (*Claytonia virginica* var. *virginica*), gray dogwood (*Cornus racemosa*), dutchman's-breeches (*Dicentra cucullaria*), wild cucumber (*Echinocystis lobata*), great St. John's-wort (*Hypericum pyramidatum*), monkey-flower (*Mimulus ringens*), muhly-grass (*Muhlenbergia mexicana*), bishop's-cap (*Mitella diphylla*), ditch-stonecrop (*Penthorum sedoides*), bur oak, green-headed coneflower (*Rudbeckia laciniata*), bloodroot (*Sanguinaria canadensis*), zigzag goldenrod (*Solidago flexicaulis*), prairie cordgrass (*Spartina pectinata*), and large-flowered bellwort (*Uvularia grandiflora*).

Of particular interest are two wetland sedges that are significantly disjunct north of their main range in Wisconsin. *Carex alopecoidea* was previously known in Wisconsin north only to St. Croix and Shawano Counties, while *C. trichocarpa* generally only occurs north to Barron County but does have an outlying station along the Bad River in Ashland County. However, the Minnesota ranges of these species (Ownbey & Morley 1991) and others such as bur oak and broad-leaved enchanter's-nightshade extend northwestwards in that state to Lake of the Woods and even the Manitoba border. Hence, the "disjunctions" of Kaukamo Spruces sites are not exceptionally "out-of-range" if we consider them in a broader geographic context.

CHECKLIST OF VASCULAR PLANTS

The following checklist is alphabetical by family, genus, and species within each major group (pteridophytes, conifers, monocots, and dicots). Scientific nomenclature follows Wetter et al. (2001), while common names follow the same source or Peterson & McKenny (1968). The following list includes 74 families, 211 genera, and 352 species of vascular plants; 68 (19%) are alien. There are 12 species of pteridophytes, 4 conifers, 98 monocots, and 238 dicots. The largest families are the Asteraceae (45 species), Poaceae (35), Cyperaceae (32), and Rosaceae (23). *Carex* (27 species) is the largest genus.

PTERIDOPHYTES

EQUISETACEAE (Horsetail Family)

Equisetum arvense L., field horsetail. Occasional, swales in fields. 10239.

E. sylvaticum L., woodland horsetail. Occasional, base of boreal slope. 10126.

OPHIOGLOSSACEAE (Adder's-tongue Family)

Botrychium virginianum (L.) Sw., rattlesnake fern. Rare, boreal slope. 10327.

OSMUNDACEAE (Flowering fern Family)

Osmunda claytoniana L., interrupted fern. Fairly common, moist openings in woods. 10243.

DENNSTAEDTIACEAE (Bracken Family)

Pteridium aquilinum (L.) Kuhn var. *latiusculum* (Desv.) A. Heller, bracken fern. Occasional, woods. 10210.

DRYOPTERIDACEAE (Wood fern Family)

Athyrium filix-femina (L.) Mert. var. *angustum* (Willd.) G. Lawson, lady fern. Common, woods. 10209, 10426.

Dryopteris carthusiana (Vill.) H. P. Fuchs, spinulose wood fern. Occasional, boreal slope. 10266.

D. cristata (L.) A. Gray, crested wood fern. Rare, swampy woods, west end. 10340.

Gymnocarpium dryopteris (L.) Newman, oak fern. Uncommon, boreal slope. 10265.

Matteuccia struthiopteris (L.) Todaro var. *pennsylvanica* (Willd.) C. V. Morton., ostrich fern. Common, bottomland. 10387.

Onoclea sensibilis L., sensitive fern. Fairly common, bottomland and swales. 10125.

PTERIDACEAE (Maidenhair fen Family)

Adiantum pedatum L., maidenhair fern. Rare, base of boreal slope. 10325.

GYMNOSPERMS

PINACEAE (Pine Family)

Abies balsamea (L.) Mill., balsam-fir. Dominant tree on boreal slope. 10131.

Picea glauca (Moench) Voss, white spruce. Scattered large trees on boreal slope. 10160.

Pinus resinosa Aiton, red pine. Rare, a few small trees in fields west of Kaukamo Road. 10129.

Pinus strobus L., white pine. Occasional large trees on boreal slope. 10130.

MONOCOTYLEDONS

ALISMATACEAE (Water-plantain Family)

Alisma triviale Pursh, water-plantain. Common, Resch Creek; also bottomland slough. 10420, 11579 (Brule).

Sagittaria latifolia L. var. *latifolia*, arrowhead, duck-potato. Local, bottomland slough. 10458.

ARACEAE (Arum Family)

Arisaema triphyllum (L.) Schott var. *triphyllum*, jack-in-the-pulpit. Occasional, bottomland and base of boreal slope. 10157.

CYPERACEAE (Sedge Family)

Carex alopecoidea Tuck. Rare, bottomland slough edge. 10395. Northernmost state site; nearest Wisconsin counties are St. Croix and Shawano.

C. arctata Hook. Uncommon, boreal forest. 10521.

C. aurea Nutt. Rare, south fence line west of Resch Creek. 10538.

C. bromoides Willd. subsp. *bromoides*. Occasional, bottomland; swales in west fields. 10293. Northernmost state site.

C. brunnescens (Pers.) Poir. subsp. *sphaerostachya* (Tuck.) Kalela. Common, forests and edges. 10212, 10273, 10292.

C. castanea Wahlenb. Abundant, fields. 10112.

C. crinita Lam. Fairly common, wet margins. 10283.

C. deweyana Schwein. var. *deweyana* Occasional, boreal slope. 10211.

C. disperma Dewey. Rare, swampy woods, west end. 10341.

C. gracillima Schwein. Abundant, fields. 10250, 11363.

C. hystericina Willd. Uncommon, riverside. 10466.

C. intumescens Rudge. Fairly common, swales. 10225.

- C. ×knieskernii* Dewey (*C. arctata* × *C. castanea*). Rare, south fence line near west border. 10304. One of only four Wisconsin sites.
- C. pedunculata* Willd. Occasional, boreal forest. 10133.
- C. pellita* Willd. Occasional, swales in west fields. 10288.
- C. peckii* Howe. Fairly common, boreal slope. 10121.
- C. projecta* Mack. Boreal slope and margin of bottomland slough. 10390, 10451, 10457, 11364.
- C. radiata* (Wahlenb.) Small. Uncommon, boreal slopes. 14427.
- C. retrorsa* Schwein. Occasional, slough and swales. 10397
- C. scoparia* Willd. Local, west fields. 10354, 10533.
- C. sprengelii* Spreng.. Uncommon, bottomland. 10151. Northernmost state site.
- C. stipata* Willd. Fairly common, swales and ditches. 10282.
- C. stricta* Lam. Local, riverside. 10337.
- C. tenera* Dewey var. *tenera*. Common, fields. 10305, 10345, 10393.
- C. trichocarpa* Willd. Rare, riverside. 10276. Northernmost state site; along with a station in Ashland County, this is disjunct north from the main range of the species (Barron County and south).
- C. tuckermanii* Dewey. Uncommon; bottomland slough and swale west of Resch Creek. 10396, 10534.
- C. vulpinoidea* Michx. Occasional, roadside ditches. 10473, 11461, 11580 (Brule).
- Eleocharis erythropoda* Steud., spikerush. Rare, riverside mud. 10502.
- E. obtusa* (Willd.) Schult., spikerush. Local, roadside and garden. 10353, 10492.
- Schoenoplectus tabernaemontani* (C. C. Gmel.) Palla, soft-stemmed bulrush. Rare in river-side mud in 1995. 11387.
- Scirpus cyperinus* (L.) Kunth, wool-grass. Common, swales and ditches. 10343, 10485.
- S. microcarpus* J. Presl & C. Presl. Occasional, ditches. 10221.

HYDROCHARITACEAE (Frog's-bit Family)

- Elodea canadensis* Michx., waterweed. Rare, submersed in river, northeast corner. 10505.

IRIDACEAE (Iris Family)

- Iris versicolor* L., blue flag. Occasional, swales and streamsides. 10297.

JUNCACEAE (Rush Family)

- Juncus arcticus* Willd. subsp. *littoralis* (Engelm.) Hultén. Common, swales in old fields. 11389.
- J. bufonius* L., toad rush. Common in driveway sand. 10352.
- J. effusus* L., common rush. Occasional, swales and ditches. 10240, 11362.
- J. nodosus* L. Rare, riverside mud. 10468, 11467.
- J. tenuis* Willd., path rush. Occasional, road-sides, driveway. 10247.
- J. vaseyi* Engelm. Rare; colony in swale in old field about 50 meters northwest of where Resch Creek enters the tract. 10481. Species of special concern, Wisconsin D.N.R. Noted in 1993 and 1996, not relocated in 2000-2001. Only Bayfield County site.
- Luzula acuminata* Raf. var. *acuminata*, wood-rush. Uncommon, boreal slope, west fields. 10111.

LEMNACEAE (Duckweed Family)

- Lemna minor* L., common duckweed. Locally common, bottomland slough. 10149.

LILIACEAE (Lily Family)

- Allium tricoccum* Aiton var. *tricoccum*, wild leek. Rare, base of boreal slope. 10400.
- Clintonia borealis* (Aiton) Raf., bluebead; corn-lily. Fairly common, boreal forest. 10316.
- Erythronium americanum* Ker Gawler, yellow trout-lily. Occasional, base of boreal slope. 10139.
- Lilium michiganense* Farw., turk's-cap lily. Occasional, streamsides and bottomland. 10336, 11456.
- Maianthemum canadense* Desf., Canada mayflower. Common, woods. 10226.
- Polygonatum pubescens* (Willd.) Pursh, Solomon's-seal. Occasional, boreal slopes. 14439.
- Smilacina racemosa* (L.) Desf., false Solomon's-seal. Occasional, boreal slope openings. 10216.

- S. stellata* (L.) Desf., starry false Solomon's-seal. Rare, rich bottomland woods. 10281.
Streptopus roseus Michx. var. *longipes* (Fernald) Fassett, rosy twisted-stalk. Occasional, boreal forest. 10258.
Trillium cernuum L., nodding trillium. Uncommon, base of boreal slope. 10155.
Uvularia grandiflora Sm., large-flowered bellwort. Uncommon, boreal slope. 10138. Northernmost state site.
U. sessilifolia L., wild oats. Uncommon, boreal slope. 10132.

ORCHIDACEAE (Orchid Family)

- Platanthera huronensis* (Nutt.) Lindl., tall northern bog orchid. Uncommon, boreal slopes. 10366.
P. lacera (Michx.) G. Don, ragged fringed orchid. Rare, moist west field swale. 10425.
P. psychodes (L.) Lindl., purple fringed orchid. Fairly common, west field swales. 10329.

POACEAE (Grass Family)

- Agrostis hyemalis* (Walter) Britton, Sterns & Poggenb. var. *scabra* (Willd.) Blomq., tickle-grass. Occasional, fields. 10430.
A. gigantea Roth, redtop. Fairly common, fields. 10542, 11453.
**Alopecurus pratensis* L. meadow foxtail. Uncommon, field, 10309.
Brachyelytrum aristosum (Michx.) Trel., slender wedge grass. Fairly common, boreal forest. 10391.
Bromus ciliatus L., fringed brome. Occasional, woods. 10427, 11458.
B. pubescens Willd., Canada brome. Local, base of boreal slope. 10384. Northernmost state site; disjunct ca. 50 miles north from other Wisconsin stations.
Calamagrostis canadensis (Michx.) P. Beauv., bluejoint. Common, wet areas. 10335, 11361.
**Dactylis glomerata* L., orchard grass. Local, edge of lawn. 10244.
Danthonia spicata (L.) P. Beauv., poverty oat-grass. Occasional, driest parts of fields. 10334.
**Digitaria ischaemum* (Schweigg.) Muhl., crabgrass. Fairly common, driveway and garden. 10491.
Echinochloa muricata L. (P. Beauv.) Fernald, barnyardgrass. Fairly common, driveway and garden. 10441, 11578 (Brule).
Elymus hystrix L., bottle-brush grass. Local, base of boreal slope. 10383.
E. virginicus L., Virginia wild-rye. Fairly common, bottomland and riverside. 10417, 11462 (Brule).
**Elytrigia repens* (L.) B. D. Jacks., quackgrass. Fairly common, fields and roadsides. 10311.
**Eragrostis pectinacea* (Michx.) Steud., love grass. Common garden weed. 10411.
**Festuca pratensis* Huds., meadow fescue. Local, near house. 10251, 10331.
F. subverticillata (Pers.) E. B. Alexeev, nodding fescue. Rare, base of boreal slope. 10398.
Glyceria grandis S. Watson, tall manna-grass. Fairly common, ditches and Resch Creek. 10392.
G. striata (Lam.) Hitchc., fowl manna-grass. Local, bottomland slough. 10377.
Leersia oryzoides (L.) Sw., rice cut-grass. Local, riverside mud in northeast corner. 10504.
**Lolium perenne* L., ryegrass. Garden weed. 10407.
Milium effusum L., wood millet. Occasional, openings in boreal slope. 10206.
Muhlenbergia mexicana (L.) Trin., muhly-grass. Rare, roadside. 10520. At northern range limit.
Oryzopsis asperifolia Michx., rice-grass. Common, boreal forest. 10144.
Panicum capillare L., witch grass. Common garden and driveway weed. 10488.
**Pennisetum glaucum* (L.) R. Br., yellow foxtail. Uncommon lawn weed. 10535.
**Phalaris arundinacea* L., reed canary grass. Local, riverside. 10346.
**Phleum pratense* L., timothy. Occasional, fields.
**Poa annua* L., annual bluegrass. Common, driveway. 10136, 10234.
**P. compressa* L., Canada bluegrass. Uncommon, driest part of west fields. 10330.
P. palustris L., fowl meadow-grass. Occasional, swales and bottomland. 10294, 10394.
**P. pratensis* L., Kentucky bluegrass. Common, fields and lawn. 10137, 10317.
Schizachne purpurascens (Torr.) Swallen, false melic. Local, base of boreal slope. 10267.
Spartina pectinata Link, prairie cord grass. A large clone along east side of Kaukamo Road. 11577 (Brule). Northernmost state site.

Sphenopholis intermedia (Rydb.) Rydb., wedge grass. Occasional in mud along Iron River. 11468, 11623.

SMILACEAE (Cat-brier Family)

Smilax herbacea L. var. *lasioneuron* (Hook.) A.DC., hairy carrion-flower. Occasional, bottomland and boreal forest. 10252. Northernmost state site.

SPARGANIACEAE (Bur-reed Family)

Sparganium emersum Rehmman, bur-reed. Common in mud of Resch Creek. 10429, 11454.

TYPHACEAE (Cat-tail Family)

Typha latifolia L., common cat-tail. Rare, Resch Creek. 10431.

DICOTYLEDONS

ACERACEAE (Maple Family)

Acer negundo L. var. *negundo*, box-elder. Common bottomland tree. 10324.

A. rubrum L., red maple. Common upland tree. 10228.

A. saccharum Marshall var. *saccharum*, sugar maple. Occasional, saplings in boreal forest. 10280.

A. spicatum Lam., mountain maple. Rare, base of boreal slope. 10262.

AIZOACEAE (Carpetweed Family)

**Mollugo verticillata* L., carpetweed. Common garden weed. 10409.

AMARANTHACEAE (Amaranth Family)

**Amaranthus retroflexus* L., pigweed. Uncommon garden weed. 10443.

ANACARDIACEAE (Cashew Family)

Rhus hirta (L.) Sudw., staghorn sumac. Rare, a few along Kaukamo Road. 10541.

Toxicodendron rydbergii (Rydb.) Greene, poison-ivy. Common, woods near house. 10213.

APIACEAE (Parsley Family)

Cicuta maculata L., spotted water-hemlock. Fairly common, swales and streamsides. 10357.

Cryptotaenia canadensis (L.) DC., honewort. Rare, base of boreal slope. 10399.

Heracleum lanatum Michx., cow-parsnip. Abundant, bottomland forest. 10388.

Osmorhiza longistylis (Torr.) DC., smooth sweet cicely. Fairly common, bottomland forest. 10275, 14426.

Sanicula marilandica L., black snakeroot. Common, boreal forest and edges. 10235.

Sium suave Walter, water-parsnip. Locally common, Resch Creek. 10414.

Zizia aurea (L.) W.D.J. Koch, golden Alexander occasional, openings in boreal forest slopes. 14424.

APOCYNACEAE (Dogbane Family)

Apocynum androsaemifolium L., spreading dogbane. Uncommon, edge of lawn northeast of house. 10439.

AQUIFOLIACEAE (Holly Family)

Ilex verticillata (L.) A. Gray, winterberry holly. Fairly common, swampy woods, especially at west end of tract. 10208.

ARALIACEAE (Ginseng Family)

Aralia nudicaulis L., wild sarsaparilla. Common, boreal forest. 10274.

A. racemosa L., spikenard. Rare, base of boreal slope. 10279.

Panax trifolius L., dwarf ginseng. Occasional, boreal forest around house. 10315.

ARISTOLOCHIACEAE (Birthwort Family)

Asarum canadense L., wild ginger. Occasional, base of boreal slope. 10143.

ASCLEPIADACEAE (Milkweed Family)

Asclepias syriaca L., common milkweed. Local, riverside thicket. 10382.

ASTERACEAE (Composite Family)

Achillea millefolium L., yarrow. Common, fields. 10344.

- Anaphalis margaritacea* (L.) Benth. & Hook., pearly everlasting. Uncommon, driest parts of west field. 10532.
- Antennaria howellii* Greene subsp. *neodioica* (Greene) R.J. Bayer, field pussy-toes. Occasional, driest part of west field (along south fenceline). 10122.
- **Arctium minus* Bernh., burdock. Rare, base of boreal slope; also near house. 10322.
- **Artemisia biennis* Willd., biennial wormwood. Uncommon garden weed. 10440.
- Aster ciliolatus* Lindl., Fairly common, woods and fields. 10508.
- A. lanceolatus* Willd., panicled aster. Fairly common, swales, ditches, and streamsides. 10509.
- A. lateriflorus* (L.) Britton, calico aster. Common, woods and fields. 10496.
- A. macrophyllus* L., large-leaved aster. Abundant, woods. 10433.
- A. puniceus* L., purple-stemmed aster. Occasional, swampy woods at west end. 10516.
- A. umbellatus* Mill., flat-topped aster. Fairly common, swales, ditches, and streambanks. 10517.
- Bidens frondosus* L., beggar-ticks. Uncommon, bottomland slough, along Resch Creek. 10498.
- **Cirsium arvense* (L.) Scop., Canada thistle. Fairly common, edge of driveway and lawn. 10495.
- C. muticum* Michx., swamp thistle. Occasional, wet swales in west fields. 10428.
- **C. vulgare* (Savi) Tenore, bull thistle. Uncommon, near house. 10360.
- Conyza canadensis* (L.) Cronq. var. *canadensis*, horseweed. Uncommon, driveway and roadside. 10519.
- **Crepis tectorum* L., hawk's beard. Rare weed in driveway parking lot. 10356, 10480, 11309.
- Erigeron annuus* (L.) Pers., daisy fleabane. Occasional, fields and riversides. 10460, 10474.
- E. philadelphicus* L., common fleabane. Uncommon, riverside and roadside ditch. 10277, 10456.
- E. strigosus* Muhl., daisy fleabane. Occasional, fields. 10523.
- Eupatorium maculatum* L., joe-pye weed. Fairly common, swales, streamsides, ditches. 10463.
- E. perfoliatum* L. var. *perfoliatum*, boneset. Rare, bank of Resch Creek. 10543.
- **Galinsoga quadriradiata* Ruiz & Pav., Kew-weed. Rare garden weed in 1995. 11632.
- **Gnaphalium uliginosum* L., low cudweed. Common garden weed. 10442.
- Helianthus giganteus* L., tall sunflower. Abundant, fields. 10423, 10476, 10537.
- **Hieracium aurantiacum* L., orange hawkweed. Fairly common, fields. 10242.
- H. kalmii* L., Canada hawkweed. Common, fields. 10497, 14428.
- **H. piloselloides* Villars, king devil. Fairly common, fields. 10406.
- Lactuca canadensis* L., wild lettuce. Occasional, fields and roadsides. 10369.
- **Leucanthemum vulgare* Lam., ox-eye daisy. Common, fields. 10370.
- **Matricaria discoidea* DC., pineapple-weed. Occasional driveway weed. 10372.
- Packera aurea* (L.) A. Löve & D. Löve, golden ragwort. Common, west field swales and west end woods. 10301.
- Petasites frigidus* (L.) Fr. subsp. *palmatus* (Aiton) Cronquist, sweet coltsfoot. Occasional, boreal forest. 10124.
- Prenanthes alba* L., white lettuce. Occasional, swales in west fields; open slope east of house. 10507.
- Rudbeckia hirta* L. var. *pulcherrima* Farw., black-eyed susan. Common, fields. 10413.
- R. laciniata* L., green-headed coneflower. Local, bottomland slough edge. 10506. Except for a Rocky Island collection that may be an escape from cultivation, this is the northernmost state site.
- Solidago canadensis* L., Canada goldenrod. Common, fields. 10515.
- S. flexicaulis* L., zigzag goldenrod. Rare, base of boreal slope. 10524.
- S. gigantea* Aiton, late goldenrod. Common, fields. 10417, 10422, 10493, 10510.
- S. juncea* Aiton, early goldenrod. Occasional, fields. 10487.
- S. nemoralis* Aiton, gray goldenrod. Local, dry parts of field along Kaukamo Road. 10479.
- S. uliginosa* Nutt., bog goldenrod. Common, swales in west fields. 10510.
- **Sonchus arvensis* L., common sow-thistle. Edge of lawn northwest of house. 10525.
- **Tanacetum vulgare* L., common tansy. Junction of driveway with Kaukamo Road. 10437.

**Taraxacum officinale* Weber, common dandelion. Occasional, lawn and roadside. 10117.

BALSAMINACEAE (Touch-me-not Family)

Impatiens capensis Meerb., spotted touch-me-not. Uncommon, wet areas; Resch Creek and bottomland slough. 10514.

BERBERIDACEAE (Barberry Family)

Caulophyllum thalictroides (L.) Michx., blue cohosh. Uncommon, rich bottomland woods in southeast corner. 10156.

BETULACEAE (Birch Family)

Alnus incana (L.) Moench subsp. *rugosa* (Du Roi) R.T. Clausen, speckled alder. Common, swales. 10162.

Betula papyrifera Marshall, white birch. Common tree. 10313.

Corylus cornuta Marshall, beaked hazelnut. Common shrub. 10231.

Ostrya virginiana (Mill.) K. Koch, hop-hornbeam. Uncommon, boreal forest. 10320.

BORAGINACEAE (Borage Family)

Cynoglossum boreale Fernald, northern comfrey. Rare, boreal forest slopes. 10319.

**Myosotis scorpioides* L., forget-me-not. Locally common, edge of bottomland slough. 10385.

BRASSICACEAE (Mustard Family)

**Barbarea vulgaris* R. Br., yellow rocket. Occasional, fields and roadsides. 10108.

**Erysimum cheiranthoides* L., wormseed-mustard. Fairly common garden weed. 10359.

**Lepidium densiflorum* Schrad., pepper-grass. Uncommon dooryard weed. 10408.

Rorippa palustris (L.) Besser var. *fernaldiana* (Butters & Abbe) Jonsell, yellow cress. Uncommon, garden and riverside. 10477.

CALLITRICHACEAE (Water Starwort Family)

Callitriche palustris L., water starwort. Occasional, in mud of Resch Creek, Iron River. 10415.

CAPRIFOLIACEAE (Honeysuckle Family)

Diervilla lonicera Mill., northern bush-honeysuckle. Occasional, boreal forest. 10350.

Linnaea borealis L. var. subsp. *longiflora* (Torr.) Hultén, twinflower. Occasional, boreal slopes. 10318.

Lonicera canadensis Marshall, Canada honeysuckle. Uncommon, base of boreal slope. 10264.

L. hirsuta Eaton, hairy honeysuckle. Occasional, boreal forest. 10256, 10364.

Triosteum aurantiacum E. P. Bicknell var. *aurantiacum*, wild coffee. Occasional, boreal forest and fields. 10217.

Viburnum lentago L., nannyberry. Common, streambanks. 10249.

V. rafinesquianum Schult., arrow-wood viburnum. Fairly common, woods and edges. 10253.

V. trilobum Marshall, highbush-cranberry. Occasional, bottomland and along Resch Creek. 10146.

CARYOPHYLLACEAE (Pink Family)

**Cerastium fontanum* Baumg. subsp. *vulgare* (Hartm.) Greuter & Burdet, mouse-ear chickweed. Fairly common, roadsides and fields. 10230.

**Silene latifolia* Poir. subsp. *alba* (Mill.) Greuter & Burdet, white campion. Uncommon weed near house. 10404.

**Stellaria aquatica* (L.) Scop., giant chickweed. Rare, riverside mud. 10462.

S. longifolia Willd., stitchwort. Local, opening in boreal slope. 10207.

CHENOPODIACEAE (Goosefoot Family)

**Chenopodium album* L., lamb's-quarters. Occasional garden weed. 10314.

**C. glaucum* L., oak-leaved goosefoot. Occasional garden weed. 10361.

CONVOLVULACEAE (Morning-glory Family)

Calystegia sepium (L.) R.Br., hedge-bindweed. Local, riverside thicket. 10499.

CORNACEAE (Dogwood Family)

- Cornus alternifolia* L.f., pagoda dogwood. Rare, boreal forest west of house. 10368.
C. canadensis L., bunchberry. Occasional, boreal forest. 10303.
C. racemosa Lam., gray dogwood. Local, south border of west fields. 10289, 11360.
C. rugosa Lam., round-leaved dogwood. Rare, base of boreal slope. 10259.
C. stolonifera Michx., red-osier dogwood. Fairly common, roadsides and swales. 10222.

CUCURBITACEAE (Cucumber Family)

- Echinocystis lobata* (Michx.) Torr. & A. Gray, wild cucumber. Fairly common, riverside thicket. 10471. Along with a city of Superior collection, the northernmost state site.

ERICACEAE (Heath Family)

- Vaccinium angustifolium* Aiton, early blueberry. Rare, swampy west end woods. 10483.
V. myrtilloides Michx., velvet-leaved blueberry. Uncommon, woods and fields. 10302.

FABACEAE (Legume Family)

- Amphicarpa bracteata* (L.) Fernald, hog-peanut. Fairly common, open slope east of house. 10257.
Lathyrus ochroleucus Hook., pale vetchling. Fairly common, roadsides and fields. 10236.
L. palustris L., marsh vetchling. Local, edge of lawn. 10219, 10367.
L. venosus Willd., veiny pea. Occasional, edge of house clearing and slopes below. 10355.
**Lotus corniculatus* L., birdsfoot-trefoil. Common, fields and roadsides. 10358.
**Medicago lupulina* L., black medick. Common lawn weed. 10233.
**Melilotus alba* Medik., white sweet clover. Uncommon roadside weed. 10432.
**M. officinalis* (L.) Pall., yellow sweet clover. Occasional weed of riverside and fields. 10379.
**Trifolium aureum* Pollich, yellow hop-clover. Occasional, fields and roadsides. 10418.
**T. hybridum* L., alsike clover. Fairly common weed, fields. 10215, 10371.
**T. pratense* L., red clover. Common, fields. 10287.
**T. repens* L., white clover. Common, fields. 10214.
Vicia americana Willd. subsp. *americana*, vetch. Common, fields and edges. 10237, 10286.

FAGACEAE (Beech Family)

- Quercus macrocarpa* Michx. var. *macrocarpa*, bur oak. Common, boreal forest openings. 10229. Second northernmost state site after Cornucopia.

FUMARIACEAE (Fumitory Family)

- Dicentra cucullaria* (L.) Bernh., dutchman's-breeches. Uncommon, base of boreal slope. 10154.

GROSSULARIACEAE (Gooseberry Family)

- Ribes americanum* Mill., wild black currant. Uncommon, west fields. 10120.
R. cynosbati L., pasture gooseberry. Uncommon, bottomland woods. 10152.
R. hirtellum Michx., smooth gooseberry. Uncommon, swampy west end woods. 10127.
R. triste Pall., swamp red currant. Occasional, base of boreal slope. 10140.

HYPERICACEAE (St. John's-wort Family)

- Hypericum majus* (A. Gray) Britton. Uncommon garden weed. 10531.
**H. perforatum* L., common St. John's-wort. Uncommon, fields and roadsides. 10290.
H. pyramidatum Aiton, great St. John's-wort. Occasional, swales in fields. 10424.

LAMIACEAE (Mint Family)

- **Clinopodium vulgare* L., wild-basil. Occasional, fields. 10332.
**Galeopsis tetrahit* L., hedge-nettle. Rare weed at edge of house clearing. 10438.
Lycopus americanus Muhl., cut-leaved water-horehound. Fairly common, streamsides and swales. 10465, 11471.
L. uniflorus Michx., northern bugleweed. Rare, edge of bottomland slough. 10452.
Mentha arvensis L. var. *canadensis* (L.) Kuntze, field-mint. Wet swales near house, also riverside thickets. 10450.
Physostegia virginiana (L.) Benth. subsp. *virginiana*, false dragonhead. Rare, riverside. 10501.

**Prunella vulgaris* L., heal-all. Common, fields and openings. 10220.

Scutellaria lateriflora L., side-flowered skullcap. Uncommon, swampy west end woods and near Resch Creek. 10416.

Stachys palustris L., marsh hedge-nettle. Uncommon, riverbank. 10453.

S. tenuiflora Willd. var. *tenuifolia*, rough hedge-nettle. Fairly common, riverside and banks of Resch Creek. 10347, 11459.

LOBELIACEAE (Lobelia Family)

Lobelia inflata L., Indian-tobacco. Rare, driveway sand and in west fields. 10436.

MORACEAE (Mulberry Family)

Humulus lupulus L., hops. Uncommon, streamside edge of bottomland forest. 10278.

OLEACEAE (Olive Family)

Fraxinus nigra Marshall, black ash. Common, bottomlands. 10227, 11464.

F. pennsylvanica Marshall, green ash. Occasional, west end forest; rare elsewhere. 10284.

ONAGRACEAE (Evening-primrose Family)

Circaea lutetiana L. subsp. *canadensis* (L.) Asch. & Magnus, enchanter's-nightshade. Occasional, bottomland woods and base of boreal slope. 10381, 10459. Second northernmost state site after Cornucopia.

Epilobium ciliatum Raf., northern willow-herb. Fairly common, moist fields, edges, and streambanks. 10434.

E. leptophyllum Raf., narrow-leaved willow-herb. Rare, wet swale on south border 200 meters west of Resch Creek. 10486, 11624.

Oenothera parviflora L., evening-primrose. Uncommon, waste ground near house. 10435.

O. perennis L., sundrops. Common, fields. 10349.

OXALIDACEAE (Wood-sorrel Family)

**Oxalis stricta* L., yellow wood-sorrel. Rare doorstep weed. 10530.

PAPAVERACEAE (Poppy Family)

Sanguinaria canadensis L., bloodroot. Uncommon, base of boreal slope. 10150. Second northernmost state site after Cornucopia.

PLANTAGINACEAE (Plantain Family)

**Plantago lanceolata* L., ribgrass. Fairly common lawn weed. 10406.

**P. major* L., common plantain. Common weed. 10375.

POLYGONACEAE (Buckwheat Family)

**Polygonum achoreum* S.F. Blake. Common driveway weed. 10373.

**P. aviculare* L., common knotweed. Common driveway weed. 10374.

**P. convolvulus* L., black bindweed. Local doorstep weed. 10527.

P. hydropiper L., water-pepper. Rare garden weed. 10363.

P. hydropiperoides Michx., false water-pepper. Noted along Resch Creek, 15 July 2001.

P. lapathifolium L., nodding smartweed. Local, driveway weed. 10478.

P. pennsylvanicum L., pinkweed. Fairly common, around house and riverside. 10494, 10500.

P. sagittatum L., tearthumb. Rare, swampy west end woods. 10539.

**Rumex acetosella* L., sheep sorrel. Occasional, fields. 10241.

**R. crispus* L., curled dock. Occasional weed, wet edges of lawn and driveway. 10310.

**R. obtusifolius* L., bitter dock. Uncommon, riverside thicket. 10469.

R. orbiculatus A. Gray, great water dock. Occasional, streambanks, sloughs, and swales. 10484.

PORTULACAEAE (Purslane Family)

Claytonia virginica L. var. *virginica*, Virginia spring-beauty. Fairly common, boreal forest. 10147. Second northernmost state site after Cornucopia.

**Portulaca oleracea* L., purslane. Uncommon garden weed. 10445.

PRIMULACEAE (Primrose Family)

Lysimachia ciliata L., fringed loosestrife. Fairly common, fields and edges. 10403.

Trientalis borealis Raf. subsp. *borealis*, starflower. Occasional, boreal forest. 10270.

PYROLACEAE (Wintergreen Family)

Pyrola asarifolia Michx., pink pyrola. Uncommon, boreal slopes. 10260.

P. elliptica Nutt., shinleaf. Uncommon, boreal forest slope. 10376.

RANUNCULACEAE (Buttercup Family)

Actaea rubra (Aiton) Willd., red baneberry. Occasional, boreal forest. 10263.

Anemone americana (DC.) A. Hara, round-lobed hepatica. Common, boreal forest. 10141.

A. canadensis L., Canada anemone. Local, boreal slope and banks of Resch Creek. 10295, 11460.

A. quinquefolia L. var. *quinquefolia*, wood anemone. Common, woods. 10113.

A. riparia Fernald, thimbleweed. Rare, roadside. 10351.

Aquilegia canadensis L., columbine. Rare, base of boreal slope. 10326.

Caltha palustris L., marsh-marigold. Occasional, swales west of Resch Creek. 10116.

Clematis virginiana L., virgin's-bower. Occasional, riverside and roadside ditch. 10461.

Coptis trifolia (L.) Salisb., goldthread. Uncommon, boreal slope. 10142.

**Ranunculus acris* L., common buttercup. Common, fields. 10246.

R. hispidus Michx., swamp buttercup. Fairly common, swales in fields. 10224.5.

R. recurvatus Poir., hooked crowfoot. Occasional, bottomland and base of boreal slope. 10269.

**R. sceleratus* L., cursed crowfoot. Rare garden weed. 10489.

Thalictrum dasycarpum Fisch. & Avé-Lall., late meadow-rue. Occasional, swales. 10348.

T. dioicum L., early meadow-rue. Uncommon, swales. 10153.

ROSACEAE (Rose Family)

Agrimonia gryposepala Wallr., agrimony. Common, fields. 10402.

Amelanchier arborea (Michx. f.) Fern., juneberry. Rare. 10307.

A. spicata (Lam.) K. Koch. Common shrub of fields and edges. 10105, 10128.

Crataegus chrysocarpa Ashe, hawthorn. Fairly common small tree of fields and edges. 10223, 10536.

Fragaria vesca L. subsp. *americana* (Porter) Staudt, wood strawberry. Rare garden weed. 10528.

F. virginiana Duchesne, wild strawberry. Fairly common, fields. 10107.

Geum aleppicum Jacq., yellow avens. Occasional, fields. 10339.

G. canadense Jacq., white avens. Uncommon, slope east of house. 10366.

G. rivale L., water-avens. Locally common, wet swales in west fields. 10300, 11457.

**Malus pumila* Mill., apple. Rare; deer-chewed saplings in west field. 10482.

**Potentilla norvegica* L., rough cinquefoil. Rare driveway weed. 10312.

**P. recta* L., rough-fruited cinquefoil. Uncommon, fields. 10135, 10299.

**P. simplex* Michx., common cinquefoil. Common, fields. 10298.

Prunus pensylvanica L.f., pin cherry. Occasional, edges, as near house. 10526.

P. virginiana L. var. *virginiana*, choke cherry. Occasional, edges, as near house. 10218.

Rosa acicularis Lindl., bristly rose. Fairly common, fields and openings. 10248.

Rubus canadensis L., smooth blackberry. Occasional, fields and edges. 10291.

R. hispidus L., bristly dewberry. Local, banks of Resch Creek. 10333.

R. parviflorus Nutt., thimbleberry. A patch at base of boreal slope east of house. 10268.

R. pubescens Raf., dwarf raspberry. Fairly common, swales and swampy woods. 10118.

R. idaeus L. var. *strigosus* (Michx.) Maxim., red raspberry. Occasional, fields and edges. 10245.

Spiraea alba Du Roi, meadowsweet. Occasional; edge of west end woods, also riverside. 10342.

Waldsteinia fragarioides (Michx.) Tratt. subsp. *fragarioides*, barren-strawberry. Abundant, fields and clearings. 10110.

RUBIACEAE (Madder Family)

Galium asprellum Michx., rough bedstraw. Locally common, banks of Resch Creek. 10296, 11455.

G. boreale L., northern bedstraw. Invading the south fields from the north. 11388.

G. tinctorium L., swamp bedstraw. Occasional, west end and bottomland woods. 10338, 10455.

G. triflorum Michx., sweet-scented bedstraw. Rare, base of boreal slope. 10261.

Mitchella repens L., partridge-berry. Uncommon, boreal forest. 10255.

SALICACEAE (Willow Family)

Populus balsamifera L. subsp. *balsamifera*, balsam-poplar. Common along river, occasional on uplands. 10161.

P. tremuloides Michx., quaking aspen. Common. 10163.

Salix bebbiana Sarg., Bebb willow. Common small tree of fields. 10114, 10238, 10308.

S. exigua Nutt. subsp. *interior* (Rowlee) Cronquist, sandbar willow. Occasional, riverside. 10380.

S. lucida Muhl. subsp. *lucida*, shining willow. Uncommon, riverside. 10378.

S. petiolaris Small, slender willow. Common, swales in fields. 10106.

SAXIFRAGACEAE (Saxifrage Family)

Mitella diphylla L., bishop's-cap. Uncommon, base of boreal slope. 10148. Northernmost state site.

M. nuda L., naked miterwort. Occasional, boreal slope. 10272.

Penthorum sedoides L., ditch-stonecrop. Locally common in mud of Resch Creek. 10512.

Second northernmost state site (after one on Madeline Island).

Saxifraga pensylvanica L., swamp saxifrage. Occasional, moist boreal slopes and swales in west fields. 10123.

SCROPHULARIACEAE (Figwort Family)

Chelone glabra L., turtlehead. Rare, Resch Creek. 10513.

Gratiola neglecta Torr., hedge-hyssop. Common garden weed; also riverbank mud. 10410, 11465.

Mimulus ringens L., monkey flower. Rare, Resch Creek. 10421, 11463.

Scrophularia lanceolata Pursh, figwort. Rare, riverside thicket. 10464.

Veronica americana Benth., American brooklime. Local in mud along the Iron River. 11470.

V. scutellata L., marsh-speedwell. Locally common in mud, Resch Creek. 10419, 10518.

**V. serpyllifolia* L., thyme-leaved speedwell. Common lawn weed. 10134.

TILIACEAE (Basswood Family)

Tilia americana L., basswood. Fairly common, bottomland; occasional, boreal forest. 10224.

ULMACEAE (Elm Family)

Ulmus americana L., American elm. Occasional small tree, bottomland and boreal slope. 10232.

URTICACEAE (Nettle Family)

Laportea canadensis (L.) Wedd., wood nettle. Fairly common, bottomland. 10386.

Urtica dioica L. subsp. *gracilis* (Aiton) Solander, stinging nettle. Occasional, bottomland. 10467.

VALERIANACEAE (Valerian Family)

**Valeriana officinalis* L., garden heliotrope. Rare weed; opening at base of boreal slope. 10321.

VERBENACEAE (Vervain Family)

Verbena hastata L., blue vervain. Local, riverside thicket. 10470.

VIOLACEAE (Violet Family)

Viola cucullata Aiton, marsh blue violet. Occasional, bottomlands. 10323.

V. labradorica Schrank, dog violet. Fairly common, fields. 10119.

V. pubescens Aiton, yellow violet. Fairly common, boreal forest. 10115.

V. renifolia A. Gray. Rare, south fenceline west of Kaukamo Road. 10164.5.

V. sororia Willd., woolly blue violet. Common, fields. 10109.

VITACEAE (Grape Family)

Parthenocissus vitacea (Kerner) Hitchc., Virginia creeper. Occasional, bottomland. 10271.

ACKNOWLEDGMENTS

I thank my brother Wyat D. Judziewicz, his wife Elaine Ruzycski, and their daughter Helen Elizabeth Judziewicz for their hospitality during my visits to this most peaceful corner of Wisconsin. Theodore S. Cochrane kindly confirmed my determinations of *Juncus vaseyi* and several carices.

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BOOK REVIEW

DeGraaff, K. M., S. R. Rushforth and J. L. Crawley. 2004. *A Photographic Atlas for the Botany Laboratory, Fourth Edition*. Morton Publishing Company, 925 W. Kenyon, Unit 12, Englewood, CA 80110, 182 pp. ISBN 0-89582-614-3; (Soft-bound) \$29.95.

The envelope was big in my departmental mailbox. When I opened it I was greeted with the magnificent color image of two large inflorescences of pink *Lupinus*. What is this, I said to myself, as I turned the paper bound book over in my hands.

The authors call this book a full color photographic atlas to all plant groups seen in a general botany laboratory. It is designed to accompany the normal college botany text and gives the student color images of the plant groups, morphological parts, and structures. They say "it provides a balanced visual representation" of what the student should see clearly and accurately with matching terminology used to fit most common college-level texts.

I call this atlas a perfect book for the amateur botanist who wants to learn about the major groups of plants "by osmosis and looking at pretty pictures." Most of our Michigan Botanical Club members are people who wish to learn

their botany in a more relaxed way and not by instruction in the formal classroom. Here is a book I think will help them: there is very little reading, the pictures and illustrations are very clear and well done, and the individual will absorb the information while viewing the well-laid-out images.

There are nine chapters with Chapter 1 beginning with the cell and tissues of plants in general. This includes mitosis and meiosis and the various stages with micrographs. Chapter 2 includes bacteria and the Archaea revealed with outstanding phase contrast images. The nitrogen cycle is diagramed to help show the inter-activeness of nitrogen fixing bacteria and gaseous nitrogen from the atmosphere necessary for plant growth. Chapter 3 is Protista, with algae; slime molds, and water molds to be found in Chapter 4. Diagrams of life cycles of these different groups are well presented in color.

Chapters 5–9 include most of the groups botany club members will be interested in. Chapter 5 talks about fungi, mushrooms, rusts and how the lichens are a blending of a fungus and an alga into a unique structural group. The liverworts, hornworts, and mosses make up Chapter 6. The scanning electron micrographs of the peristome of *Mnium* might even make a vascular plant botanist get interested in these “belly plants.”

When I came to the remaining three chapters I really licked my lips. Chapter 7 has color images of sori, sporangia, crozier, and frond morphology of many genera and groups to give the student of plants a fine introduction to the morphology and reproduction of these diverse groups. Each diverse pteridophyte has a colored life cycle given so there should be no misunderstanding what is happening when a plant is found in the wild or cultivated situation. Many atlases produced in this country center only around the conifers and especially *Pinus*. Not this atlas. There are wonderful close-up photographs of anatomy, seedlings, pollen, and lesser known groups like *Araucaria* from the Southern Hemisphere, and two of the strangest examples: *Ephedra* (Mormon Tea) and *Welwitschia* from the desert of Namibia, SW Africa.

Chapter 9 covers from page 114–170 and is the crowning chapter for the book. It begins with illustrating the unique double fertilization feature found only in flowering plants; that is, angiosperms: monocots and dicots. There are images of roots, stems and leaves of the vegetative morphology—even fossil leaves. The amateur will like the pages of fruit types followed by pages of representative specimens of angiosperm family diversity. The book concludes with an adequate Glossary and an in-depth index to make finding the correct page where an item is found easier. Nothing is more frustrating than an incomplete index.

The next time a member of the general public asks me for the name of a book to help them understand the complex world of botany I will tell them to check out *A Photographic Atlas for the Botany Laboratory*. It's not for the laboratory anymore. At \$29.95 it is a very good buy for your money.

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THE BIG TREES AND SHRUBS OF MICHIGAN

41. *Quercus muehlenbergii* Engelmann Chinkapin Oak

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The largest known Chinkapin Oak in Michigan is located in the city of Ann Arbor in Washtenaw County in the southeast part of the Lower Peninsula.

Description of the Species: The Chinkapin Oak belongs to the family Fagaceae or Beech family. Besides the oaks, all of which are distinguished by the production of acorns, other members of this family in Michigan include the American Beech, European Beech, and the American Chestnut. The Chinkapin Oak can be distinguished from all other oaks in Michigan by having leaves which are coarsely toothed (see Fig. 1) rather than being entire, lobed, or deeply cut, and by having acorns which are sessile or short-stalked. In Michigan this tree occurs only in the southern half of the Lower Peninsula.

Location of Michigan's Big Tree: The largest known Chinkapin Oak in Michigan is located in Wurster Park in the city of Ann Arbor. The tree can be reached by taking I-94 to exit 175 (Ann Arbor-Saline Road) toward Ann Arbor. This becomes Main Street in downtown Ann Arbor. Continue north on Main Street past the University of Michigan Stadium. Turn left on Mosley Street and go five blocks to Wurster Park. Or, if you miss Mosley Street, turn left on Madison Street and go for six blocks to the park. This is a small park and the tree is easy to spot on a slope above the grassy center of the park. In addition to the Chinkapin Oak, the park has a very nice 175" Red Oak. The GPS coordinates for the Chinkapin Oak are N 42° 16.314' and W 83° 45.261'. Thanks to Gail McPherson of Global ReLeaf of Michigan and Richard Pomorski of the Michigan Big Tree Hunt Committee for help in locating this tree.

Description of Michigan's Big Tree: The tree has a single solid, healthy trunk. Its girth at 4½' above the ground was measured on 30 July 2003 at 215" (5.5 m). The tree was 120' (36.6 m) high and had a crown spread of 62' (18.9 m). The total points for this tree are $215 + 120 + \frac{1}{4} \times 62 = 351$.

INVITATION TO PARTICIPATE

If you would like to join in extending this series of articles by visiting and describing one or more of Michigan's Big Trees please contact Elwood B. Ehrle at woodyehrl@aol.com for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission

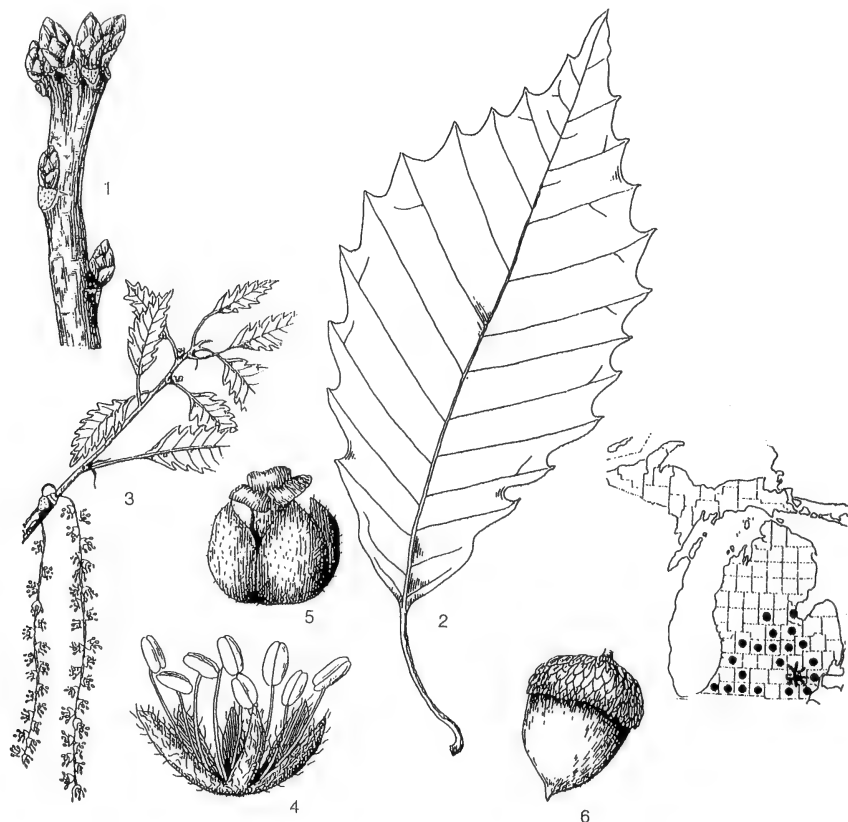


FIGURE 1. Characteristics of the Chinkapin Oak and location of Michigan's Big Tree. The map is from Voss (1985). The asterisk on the map indicates the location of Michigan's Big Tree. The drawings are from Barnes & Wagner (1981). 1. Winter twig $\times 2$. 2. Leaf, $\times \frac{1}{2}$. 3. Flowering shoot, $\times \frac{1}{2}$. 4. Male flower, enlarged. 5. Female flower, enlarged. 6. Fruit, acorn, $\times 1$.

before entering private property. For the most recent list of Michigan's Big Trees see Ehrle (2003).

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THE BIG TREES AND SHRUBS OF MICHIGAN

42. *Quercus bicolor* Willd.

Swamp White Oak

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Michigan's largest known Swamp White Oak is located near Fenwick in Montcalm County of Michigan's Lower Peninsula. This tree replaces the Grosse Ile tree described in Fordyce, Ehrle, and Thompson (1993), which was destroyed during a storm. The Grosse Ile tree was originally #3 in this series.

Description of the species: Oaks are members of the Beech Family, Fagaceae. The American Beech (*Fagus grandifolia* Ehrh.) and the American Chestnut (*Castanea dentata* (Marshall) Borkh.) comprise the members of the other genera of Fagaceae found in Michigan (Voss 1985). *Quercus* is distinct from the other genera by having an acorn, a one-seeded dry indehiscent fruit. Leaves of oaks range from entire to deeply lobed. Voss (1985) listed seventeen species of *Quercus* in his *Michigan Flora*. The Swamp White Oak is in the white oak group, distinguished by leaves with lobes being rounded or blunt without a bristle tip. Acorns in the white oak group are among the leaves at the branch tip where they ripen in their first year. Swamp White Oak is distinguished from the other oaks of Michigan by having acorns in pairs usually on a long peduncle (Fig. 1). The leaves are often irregularly lobed, dark green and shiny above, white and densely pubescent below. Swamp White Oaks are characteristic of damp lowland forests (Curtis 1959).

Location of Michigan's Big Tree: The largest Swamp White Oak in Michigan is located near Fenwick in Montcalm County in the south-central part of Michigan's Lower Peninsula. To reach the tree, take Michigan Route 66 (M66) north 9.2 miles from the center of Ionia to County Line Road (Bricker Rd.). Turn right onto unpaved Bricker Road. Continue for 0.9 mi. past #1075 Bricker Rd. Turn right onto Stedman Rd. and go 0.1 mi. to a farm field. The tree can be seen from the road at the back of the field. Its GPS location is N 43°7.075' by W 85°2.367'. Thanks to Robert Franke for help in locating this tree.

Description of Michigan's Big Tree: The tree has a single solid, healthy trunk. The circumference of the trunk at 4½' above the ground was measured on 5 June 2003 by Elwood B. Ehrle, Robert Franke and Ronald Jewell. The girth was 214" (544 cm [diameter = 68" (173 cm)]). The tree is 70' (21.3 m) tall and has a crown spread of 96' (29.3 m).



FIGURE 1. Documented distribution in Michigan and characteristics of the swamp white oak. Map is from Voss (1985). The star indicates the location of Michigan's Big Tree. Drawings are from Barnes & Wagner (1981). 1. Winter twig, $\times 2$. 2. Leaf, $\times 2$. 3. Flowering shoot, $\times 2$. 4. Male flower, enlarged. 5. Female flower, enlarged. 6. Fruit, acorn, $\times 1$.

INVITATION TO PARTICIPATE

If you would like to join in extending this series of articles by visiting and describing one or more of Michigan's Big Trees please contact Elwood B. Ehrle for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical club encourages your involvement in this activity. Please remember to ask permission before entering private property. For the most recent list of Michigan's Big Trees see Ehrle (2003).

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On the cover: The Mayapple, Podophyllum peltatum, of the Berberidaceae, Barberry Family, is host to Mayapple Rust, Puccinia podophylli Schweinitz. The fungus produces a non-systemic infection on the new growth of the Mayapple in the spring; the teliospores overwinter in the soil, and then produce the basidiospores, which fly in the breeze and infect the Mayapple. It is a leaf pathogen that produces bright orange lesions on the leaves about two weeks after they open.

These are the aecia, and they produce aeciospores that infect other Mayapples in the plant colony and nearby colonies. In time, the lesions on the leaves turn dark as they begin to produce telia, the overwintering spore, the teliospore. A second generation of aecia and aeciospores may occur on the same plant. This rust is described as autoecious ("self" house; requiring only one host to complete its life cycle) and microcyclic (lacking urediospores). Another more famous rust is Puccinia graminis, Black Stem Rust of Wheat, which produces aecia (and aeciospores) on the Barberry and uredia (and urediospores) and telia (and teliospores) on cultivated wheat, with large economic losses. Puccinia graminis is therefore heteroecious (occupying two different houses); i.e., it requires two different hosts to complete its life cycle, which Mayapple rust does not. Essentially all flowering plants and many conifers and ferns are hosts to rust fungi. For more information on this fungus, see Parker, M.A. 1989. Disease impact and local genetic diversity in the clonal plant Podophyllum peltatum. Evolution 43: 540-547. —John Rippon, 504 Georgetown Place, Clearwater, Florida 33755; 727. 725. 4292; jwlrrippon@aol.com